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2017-2018
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सीएसआईआर–केंद्रीय विद्युतरसायन अनुसंधान संस्थान

CSIR-Central Electrochemical Research Institute

[वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद]

[Council of Scientific and Industrial Research]

कारैकुडी, तमिलनाडु, भारत

Karaikudi, Tamil Nadu, India

Industrial Conclave

AUG 19, 2017 - HOTEL GREEN PARK, CHENNAI

CSIR-CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE



Industrial Conclave held on August 19, 2017 at Hotel Green Park, Chennai



Preamble...

निदेशक की कलम से



मैंने, सीएसआईआर–सीईसीआरआई को गत कई वर्षों के दौरान कई क्षेत्रों में प्रशंसनीय प्रगति करते हुए देखा है और यह वार्षिक रिपोर्ट वर्ष 2017–18 के दौरान हुई सभी महत्वपूर्ण गतिविधियों पर एक संक्षिप्त झलक प्रदान करती है। कई कारणों से यह वर्ष सीएसआईआर–सीईसीआरआई के लिए काफी अच्छा रहा है ।

हमारे कई कर्मचारियों की गहन प्रतिबद्धता और कड़ी मेहनत के कारण हम पहली बार लगभग 11 करोड़ का अभूतपूर्व राजस्व अर्जित कर पाए हैं । इस लंबी सफर में हम कई कठिन समय से गुजरे हैं, हमने कई नई तरकीबें सीखीं, अक्सर दीर्घकालिक आलोचनाओं को आमंत्रित करते रहे, फिर–भी हर प्रकार से यह सफर संतोषजनक और फलदायी रहा । इसमें, हमें सीएसआईआर के महानिदेशक, अनुसंधान परिषद के अध्यक्ष, अनुसंधान परिषद के प्रतिष्ठित सदस्यों और शिक्षाविदों का मार्गदर्शन प्राप्त हुआ । विशेष रूप से टीटीबीडी और पीपीएमजी इन दोनों अनुभागों ने क्रय, वित्त और प्रशासन के साथ सक्रिय रूप से कार्य करने में एक महत्वपूर्ण भूमिका निभाई है । चेन्नई में आयोजित औद्योगिक सम्मेलन ने राजस्व अर्जन में काफी वृद्धि करने और संक्षारण संरक्षण के क्षेत्र में प्रौद्योगिकी के हस्तांतरण में भी सहायता दी है ।

हमारी नवीनतम एफटीपी प्रौद्योगिकी – पोर्टेबल मृदा परीक्षण सेंसर किट, काफी प्रशंसनीय रही है और अब हम इसे पूर्ण एवं कॉम्पैक्ट बनाने के लिए कठोर क्षेत्र–परीक्षण में लगे हैं । थर्मल बैरियर कोटिंग से संबंधित एक अन्य एफटीपी कार्यक्रम सामरिक दृष्टि से महत्वपूर्ण है । इसी प्रकार, बड़े स्तर का जिंक–ब्रोमाइन रेडॉक्स फ्लो कार्यक्रम ऊर्जा क्षेत्र में बहुत अधिक महत्व रखता है। मैं हमारी लिथियम–आयन बैटरी तकनीक को अंतिम लाभार्थियों तक पहुंचना देखना चाहूंगा । कौशल विकास, पुनश्चर्या पाठ्यक्रम, जिग्यासा, संकाय विकास कार्यक्रम इत्यादि के कार्यान्वयन में हमारी कौशल विकास टीम सीएसआईआर में भी अग्रणी रही है।.

हालांकि, यह संभव नहीं होता, यदि आत्मविश्वास मजबूत नहीं हो । हम सभी, विशेष रूप से हमारे युवा वैज्ञानिक न केवल अनुसंधान कार्य में उत्कृष्ट हों, बल्कि अन्य क्षेत्र जैसे बी.टेक, पीएचडी छात्रों को पढ़ाना, कौशल विकास और आउटरीच गतिविधियों में भी विशिष्ट हों, जिससे हमारी प्रतिष्ठा एवं गौरव में और अधिक वृद्धि हो । हमारे कई कर्मचारी एवं छात्र, वैश्विक एवं राष्ट्रीय स्तर पर उल्लेखनीय उपलब्धियां लाए हैं । इस संस्थान को सीएसआईआर की सर्वश्रेष्ठ प्रयोगशालाओं में से एक बनाने में प्रत्येक का अपना योगदान रहा जिसका अपना महत्व है । हमारे समक्ष कई गंभीर एवं महत्वपूर्ण चुनौतियां हैं और मुझे उम्मीद है कि हम अधिक उत्साह और सहक्रियता के साथ इन पर जीत पाने के लिए सामूहिक रूप से कार्य करेंगे ।

मुझे वर्ष 2017–18 की इस वार्षिक रिपोर्ट के माध्यम से पिछले साल की गतिविधियों और प्रगति को साझा करने में प्रसन्नता हो रही है। आप हरेक के साथ काम करते मुझे आनंद मिला और मैंने बहुत कुछ सीखा भी । मुझे पूरा विश्वास है कि आने वाले वर्षों में सीएसआईआर–सीईसीआरआई की एक अद्भुत उपयुक्तता होगी एवं भविष्य काफी उज्ज्वल होगा ।

विजयमोहनन के. पिल्लै

From the Director's Desk



I have seen CSIR-CECRI making commendable progress in many areas during the past several years and this Annual Report gives a cursory glance of all our important activities during 2017-18. It has been a great year for CSIR-CECRI due to many reasons!

First, with deep commitment and hard-work of many of our staff, we could achieve an unprecedented revenue generation of nearly 11 crores, perhaps for the first time. Throughout this long journey, we went through hard times, learnt many new tricks, often inviting long-simmering criticisms, but the journey by all measures, was deeply satisfying and fruitful. In this, we were guided by DG-CSIR, RC Chairman, distinguished RC Members and academicians. Two sections, TTBD and PPMG, in particular, played a pivotal role in creating the necessary synergy with Purchase, Finance and Administration. The industrial conclave we organized at Chennai also helped in enhancing the revenue generation and to transfer couple of technologies in corrosion prevention.

Our latest FTTP technology, the Portable Soil Test Sensor Kit, won much appreciation and we are now putting in through rigorous field trials to make it complete and compact. Another FTTP program related to Thermal Barrier Coating is a strategically important one; similarly, the large-level Zinc-Bromine Redox Flow program is of much national importance in the energy sector. I would also like to see our Lithium-Ion battery technology reaching the ultimate beneficiaries. Our Skill Development team also emerged as front-runners across CSIR in implementing the skill development, refresher courses, JIGYASA, Faculty Development programmes, etc.

All this will not, however, happen if complacency gets the upper hand. All of us, especially our young scientists, should excel not only in research, but also in other domains such as teaching B.Tech. and Ph.D. students, skill development and outreach activities thereby adding to our reputation and prestige. Many of our staff and students made remarkable achievements, both globally and nationally. Each and every one of them had their share, however incremental it may be, in leapfrogging the status of this Institute to one among the best CSIR laboratories. There are many critically important challenges and I hope we will work collectively to overcome these with more passion and synergy.

I am delighted to share our last year's activities and developments through this Annual Report 2017-18. I have enjoyed and learnt many things working with each one of you and I am confident that CSIR-CECRI has a great relevance and bright future in the coming years.

Vijayamohanan

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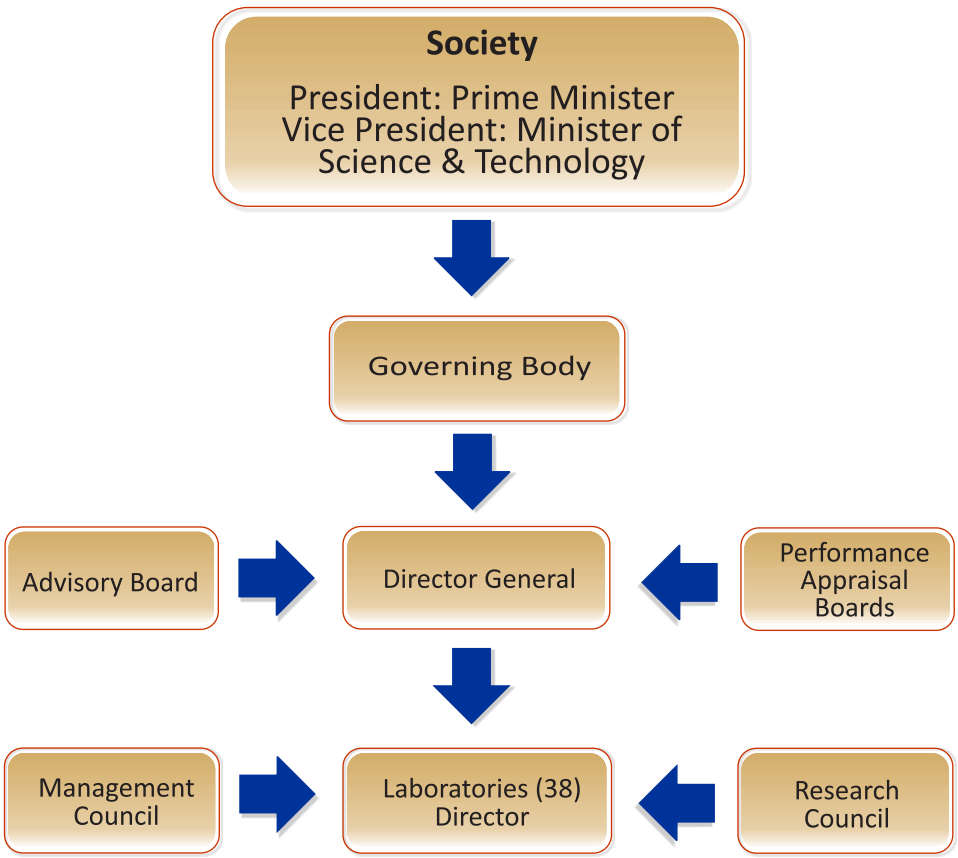
COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH
ORGANIZATIONAL STRUCTURE



संकल्पना & मिशन / VISION & MISSION

संकल्पना / Vision

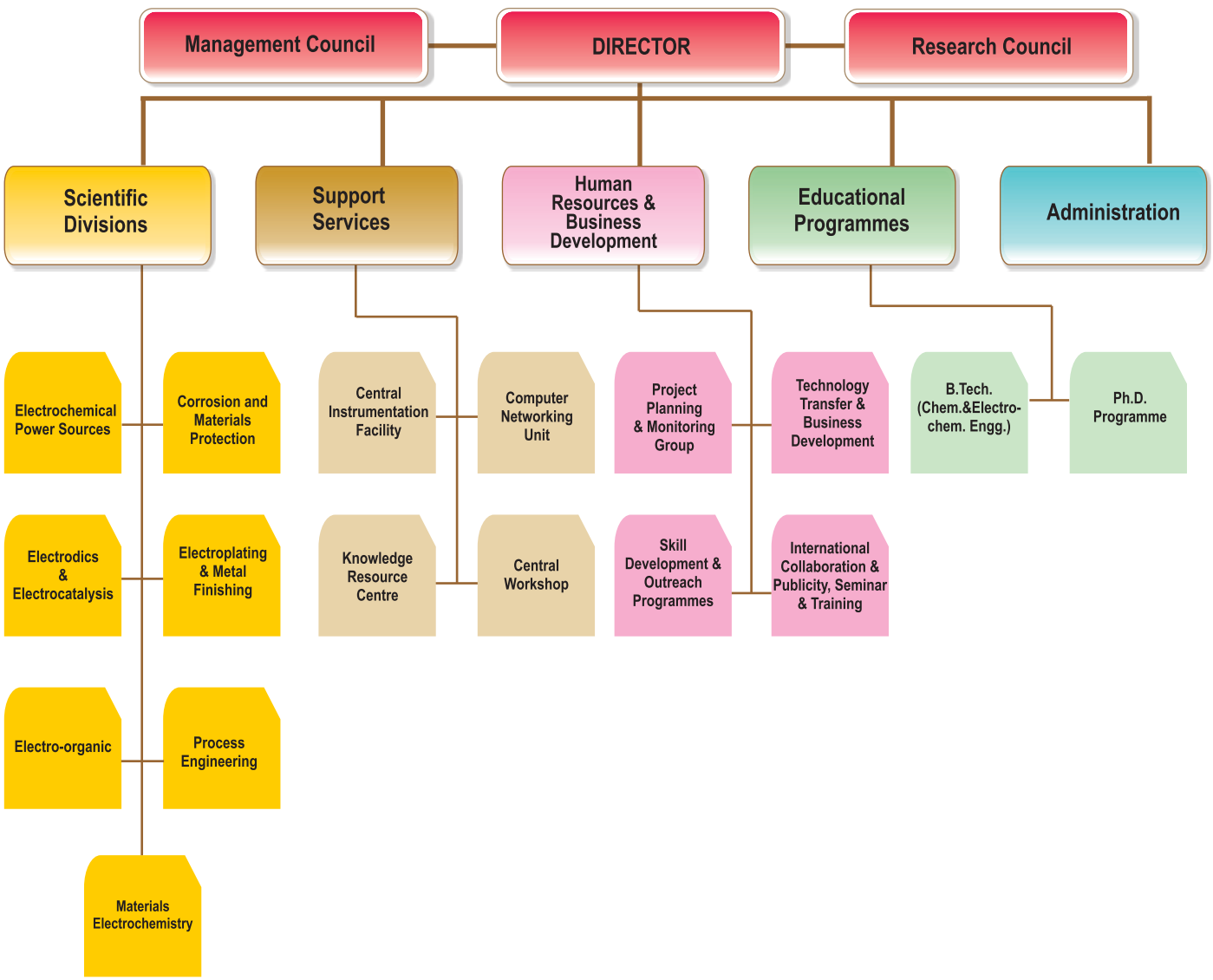
संक्षारण विज्ञान एवं अभियांत्रिकी, ऊर्जा रूपांतरण एवं संचयन, प्रकार्यात्मक पदार्थ तथा पर्यावरण को समर्पित और सतत प्रयासों के द्वारा विद्युतरसायन विज्ञान और प्रौद्योगिकी के क्षेत्र में एक वैश्विक अनुसंधान एवं विकास केंद्र के रूप में सक्रिय रहना I To be a leading global R&D centre for electrochemical science and technology through sustained and dedicated efforts focusing on corrosion science and engineering, energy conversion and storage, functional materials and environment.

मिशन / Mission

विद्युतरसायन विज्ञान एवं अभियांत्रकी के सभी पहलुओं में अग्रणी होना तथा सामाजिक लाभ के लिए ऊर्जा, पर्यावरण,स्वास्थ्य तथा पदार्थ संरक्षण में विश्व स्तरीय प्र तिस्पर्धात्मक और पर्यावरण–अनुकूल प्रैद्योगिकियों का विकास करना ।

To excel in all aspects of electrochemical science and engineering, and to develop globally competitive and eco-friendly technologies in energy, environment, health and materials conservation for societal benefits.

ORGANIZATIONAL CHART



सीएसआईआर –सीईसीआरआई



केंद्रीय विद्युतरसायन अनुसंधान संस्थान(सीईसीआरआई) की स्थापना वर्ष 1948 में हुई । इसकी नींव डॉ. आर एम अलगप्पा चेट्टियार, पंडित जवहरलाल नेहरू एवं डॉ. शांति स्वरूप भटनागर की राष्ट्रभक्ति, राष्ट्र के विकास की भावना की परिचायक है । दिनांक 14 जनवरी 1953 को डॉ. एस. राधाकृष्णन ने सीएसआईआर की इस 12वीं राष्ट्रीय प्रयोगशाला 'सीईसीआरआई' को राष्ट्र को समर्पित किया । आज सीईसीआरआई 321 कर्मचारियों का गौरवमयी परिवार है, जिनमें से 113 वैज्ञानिक हैं । कारैकुडी में स्थित यह संस्थान दक्षिण एशिया में विद्युतरसायन पर अनुसंधान हेतु स्थापित सबसे बड़े अनुसंधान केंद्र का प्रतिनिधित्व करता है । चेन्नै, मण्डपम तथा तूतीकोरिन में सीईसीआरआई के विस्तार केंद्र हैं । 10.06 डिग्री अक्षांश तथा 78.8 रेखांश पर स्थित सीईसीआरआई, मदुरै और तिरुची दोनों शहरों से लगभग 90 कि.मी. की दूरी पर है । सीईसीआरआई का परिसर अनोखे पक्षियों से भरा और वातावरण काफी हरा–भरा और शांत है, जो कि अनुसंधान कार्यों के लिए पूर्ण रूप से अनुकूल है ।

पंडित जवाहरलाल नेहरू ने संस्थान की आधारशिला की स्थापना के दौरान अपने अभिभाषण में कहा था कि "मेरा यह विश्वास है कि ऐसी स्थापनाओं को एवं विज्ञान को जनहित से जोड़ने पर हम अधिक संख्या में लोगों को प्रगति की ओर अग्रसर करा सकतें हैं ।" उनके इन शब्दों को यथार्थ में परवर्तित करते हुए सीईसीआरआई – भारतीय विद्युतरसायन उद्योग के लिए बहुमुखी प्रौद्योगिकियों के प्रक्षेपण स्थल के रूप में उभरा है । ऐसे समय में जब विद्युतरसायन को विश्वविद्यालयों में भौतिक रसायन पाठ्यक्रम में गौण स्थान दिया जाता था, डॉ. अलगप्पा चेट्टियार ने मात्र विद्युतरसायन के लिए समर्पित इस राष्ट्रीय प्रयोगशाला की स्थापना के लिए वर्ष 1948 में 300 एकड़ जमीन और 15 लाख रुपए की नकद राशि प्रदान की, निश्चित रूप से यह उस महानायक की लोक – कल्याण की भावना एवं दूरदर्शिता ही थी ।

अपनी स्थापाना के उद्देश्य को पूरा करते हुए, यह संस्थान विद्युतरसायन विज्ञान एवं प्रौद्योगिकी के सभी पहलुओं, जैसे संक्षारण विज्ञान तथा अभियांत्रिकी, विद्युतरसायन पदार्थ विज्ञान, प्रकार्यात्मक पदार्थ तथा नैनोस्केल विद्युतरसायन, विद्युतरसायन ऊर्जा स्रोत, विद्युतरसासन प्रदूषण नियंत्रण, विद्युतरसायन, इलेक्ट्रॉडिक्स तथा इलेक्ट्रोकेटालाइसिस, विद्युत–धातु–विज्ञान, औद्योगिक धातु परिष्करण, कम्प्यूटर नेट्वर्किंग तथा उपकरण से सम्बंधित क्षेत्रो में कार्यरत है। सभी प्रकार की सुविधाओं से सम्पन्न इस संस्थान में विद्युरसायन के सभी पहलुओं पर सभी प्रकार के शोध कार्य किए जाते है । सीईसीआरआई के प्रयास सदैव विद्युतरसायन विज्ञान तथा प्रौद्योगिकी के क्षेत्र में नवीन एवं उन्नत उत्पादों तथा प्रक्रमों के विकास के साथ–साथ नवोन्मेष उन्मुख होते हैं । सीईसीआरआई, भारतीय तथा विदेशी प्रयोगशालाओं एवं कंपनियों के सहयोग से कई परियोजनाओं पर कार्य कर रहा है ।

सीईसीआरआई, भारतीय उद्योग को सर्वेक्षण एवं परामर्शी परियोजनाओं आदि के माध्यम से अपना सहयोग प्रदान करता है। इसके अतिरिक्त यह संस्थान उद्योग तथा शिक्षा के हित में अल्पकालिक पुनश्चर्या पाठ्यक्रम भी आयोजित करता है । सीईसीआरआई द्वारा मानव संसाधन विकास कार्यक्रम के अंतर्गत रसायन और विद्युतरसायन अभियांत्रिकी पर आधारित अन्ना विश्वविद्यालय के बी.टेक पाठ्यक्रम के साथ – साथ सीएसआईआर द्वारा आरंभ की गई वैज्ञानिक और नवीकृत अनुसंधान अकादमी के पाठ्यक्रम भी चलाए जाते हैं । संस्थान द्वारा शोधकर्ताओं को उत्कृष्ट पुस्तकालय तथा अत्याधुनिक एवं अभिनव विश्लेषणात्मक और विशिष्टता – सुविधाएं उपलब्ध कराई जाती हैं । सीईसीआरआई, विज्ञान के प्रचार–प्रसार हेतु राष्ट्रीय और अंतर्राष्ट्रीय सम्मेलनों का आयोजन भी करता है । सीईसीआरआई अपने सामाजिक दायित्वों के प्रति जागरूक है एवं इसलिये यह 'उद्यमी विकास' और सीएसआईआर युवा विकास कार्यक्रम आदि में सक्रियता से भाग लेता है । सीईसीआरआई को कई प्रतिष्ठित पुरस्कार प्राप्त हुए हैं ।

ABOUT CECRI



The Central Electrochemical Research Institute (CECRI), founded in 1948, has its roots in the patriotic fervor of Dr. R. M. Alagappa Chettiar, Pandit Jawaharlal Nehru and Dr. Shanti Swarup Bhatnagar, who conceived the idea of a dedicated research center of electrochemistry in order to cater the demands and needs of society. On January 14, 1953 CECRI became a physical reality when Dr. S. Radhakrishnan dedicated CECRI, the twelfth national laboratory under the CSIR umbrella, to the nation. CECRI today is a proud family of 321 employees, including 113 scientists and other staff. It represents the largest research establishment of electrochemistry in South Asia. Headquartered at Karaikudi, CECRI has extension centers at Chennai, Mandapam and Thoothukudi. Located at latitude of 10.06° and longitude of 78.8°, CECRI, Karaikudi is about 90 km away both from Trichy and Madurai. The CECRI campus has a unique ecosystem of flora and fauna and is ample green and serene making it an apt ambience for R&D work.

In his address on the occasion of laying the foundation stone of the institute, Pandit Nehru said, "....*I believe that by such undertaking and by yoking science to public good we can advance lot of the people of India enormously*". In translating those words into action, CECRI has blossomed into a launching pad for a multitude of technologies for the Indian electrochemical industry. Naturally, reflecting on the fact that the inimitable Dr. Alagappa Chettiar donated 300 acres of land and Rs.15 lakh as cash in 1948 to establish a national laboratory devoted solely to Electrochemistry at a time when Electrochemistry was relegated to the flip-side of Physical Chemistry syllabi in universities, one cannot miss the rare philanthropy and foresightedness of this great visionary.

In living up to its *raison d'etre*, the institute works on a gamut of problems covering all facets of electrochemical science and technology: viz., Corrosion Science and Engineering, Electrochemical Materials Science, Functional Materials and Nanoscale Elecctrochemistry, Electrochemical Power Sources, Electrochemical Pollution Control, Electrochemicals, Electrodics and Electrocatalysis, Electrometallurgy, Industrial Metal Finishing, Computer Networking and Instrumentation. The institute provides a single and unique canopy under which all aspects of electrochemistry and related areas are investigated upon in all their dimensions. CECRI's activities are directed towards the development of new and improved products and process as well as innovations in electrochemical science and technology. CECRI runs several projects in collaboration with laboratories and private companies within and outside India.

CECRI assists the Indian Industry by conducting surveys and undertaking consultancy projects. The institute also conducts short-term refresher courses for the benefit of the industry and academia. As part of its human resource development programme, at present CECRI runs Anna University's B.Tech. course in Chemical & Electrochemical Engineering as well as Academy of Scientific and Innovative Research (AcSIR) introduced by CSIR. CECRI is equipped with an excellent library as well as the state-of-the-art analytical and characterization facilities at the institute. CECRI also organizes national and international conferences for dissemination of scientific knowledge. CECRI is alive to societal obligations and participates in such activities as 'entrepreneur development' and CSIR's youth development programme. CECRI is a recipient of many prestigious awards.

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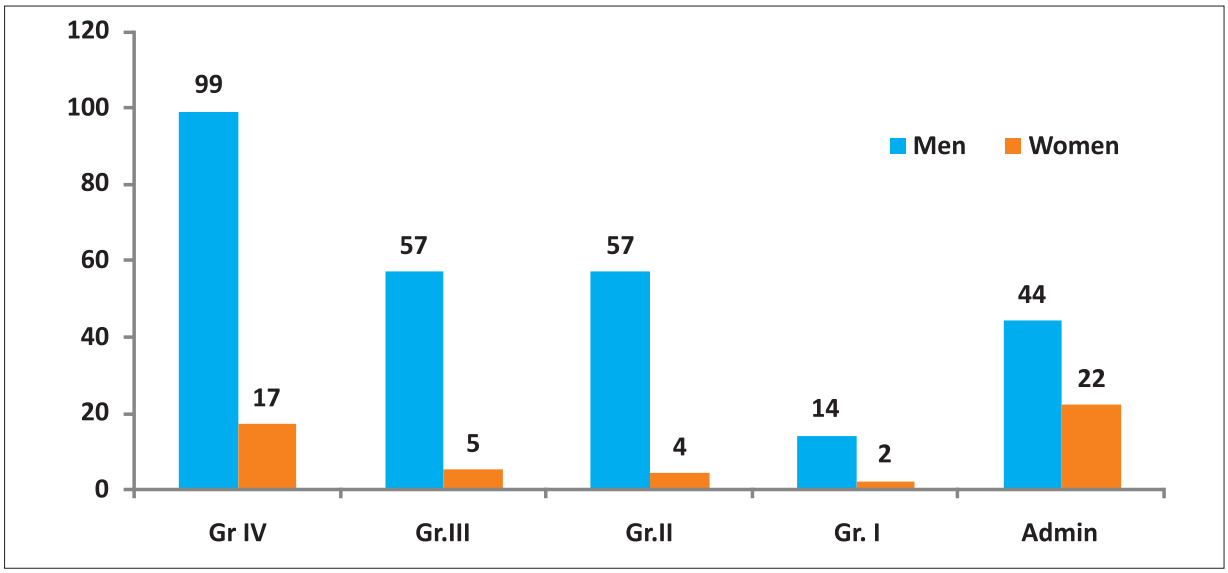
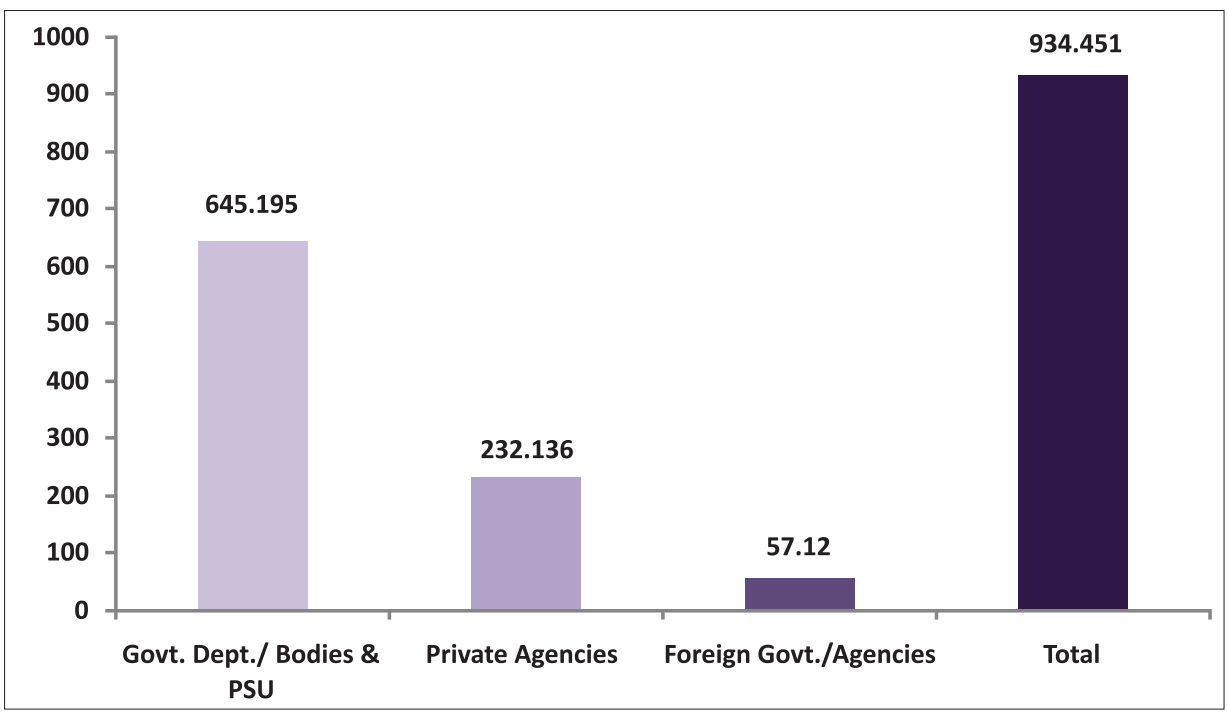
CECRI's Human Resource

As on 31.03.2018



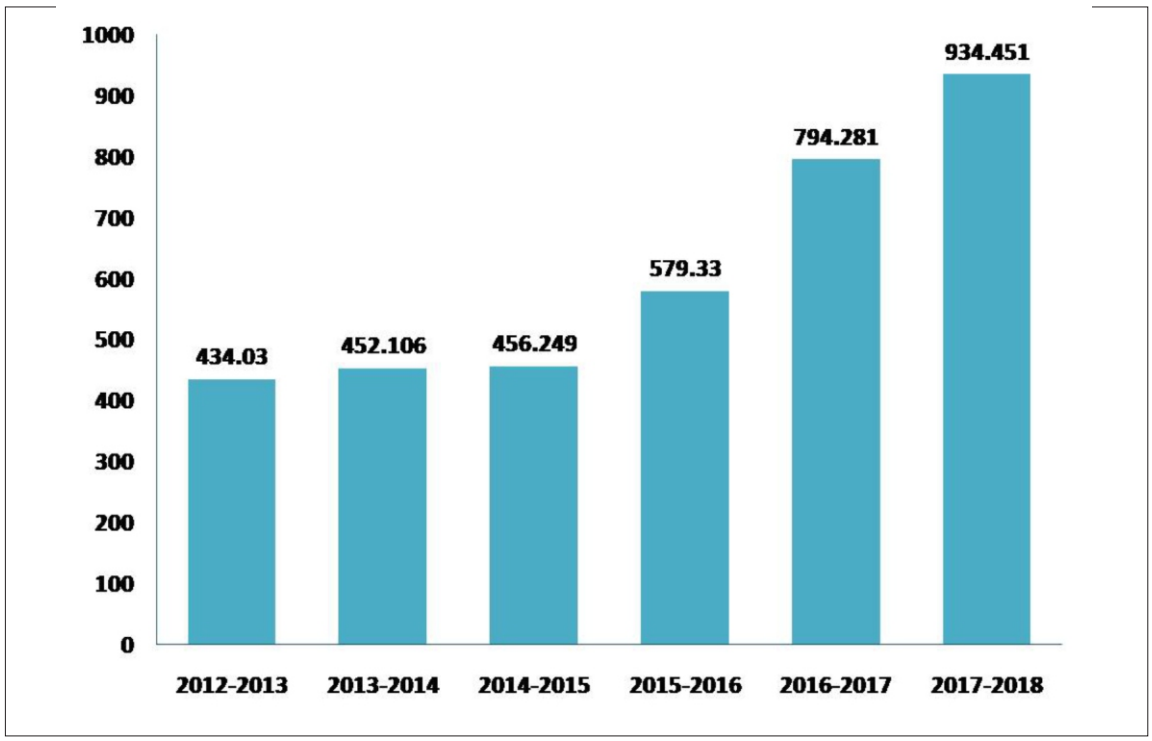
External Cash Flow during 2017-2018

(Rs. in Lakh)



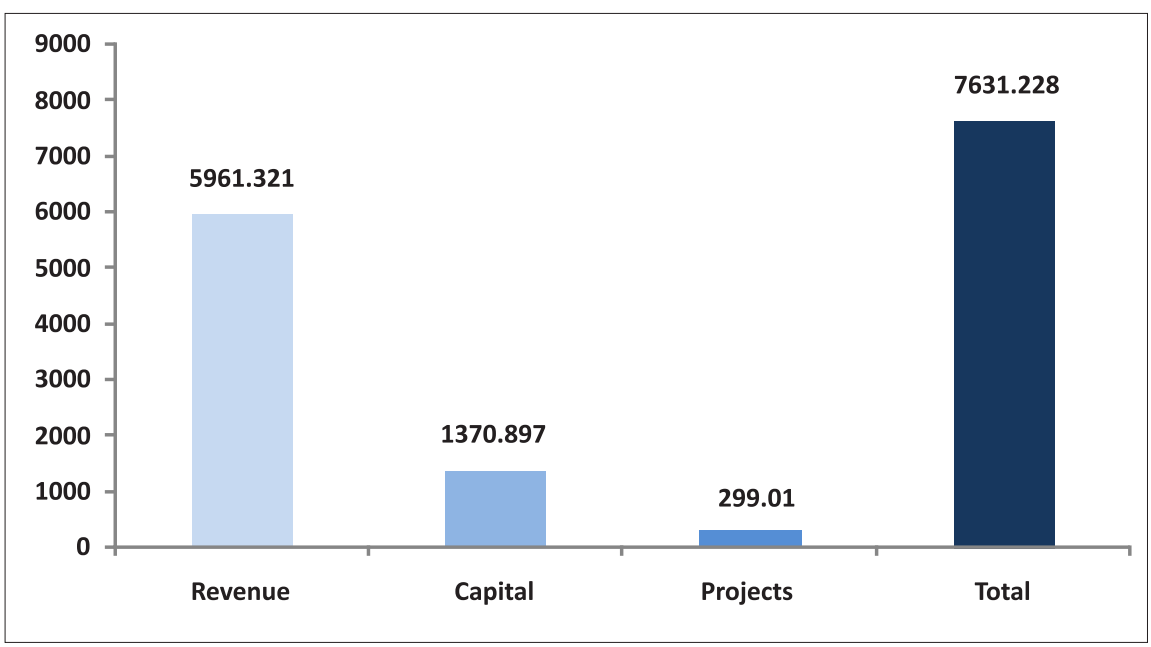
ECF at a Glance (2012-2018)

(Rs. in Lakh)



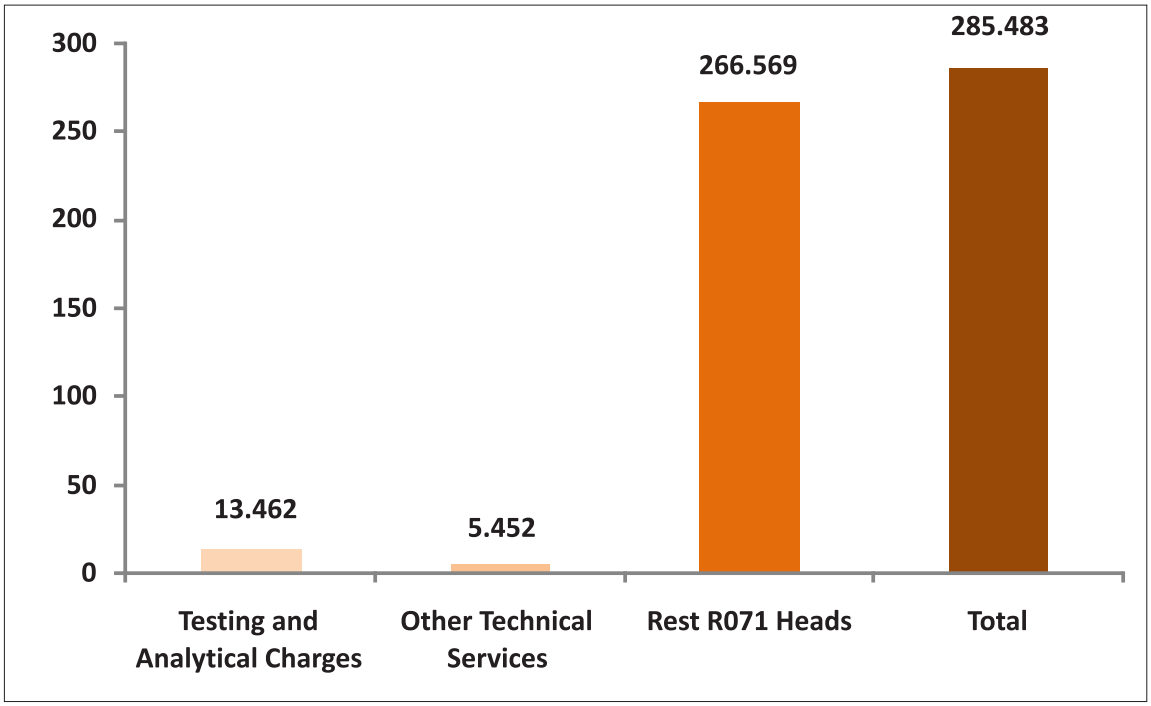
CSIR Resource Input (2017-2018)

(Rs. in Lakh)



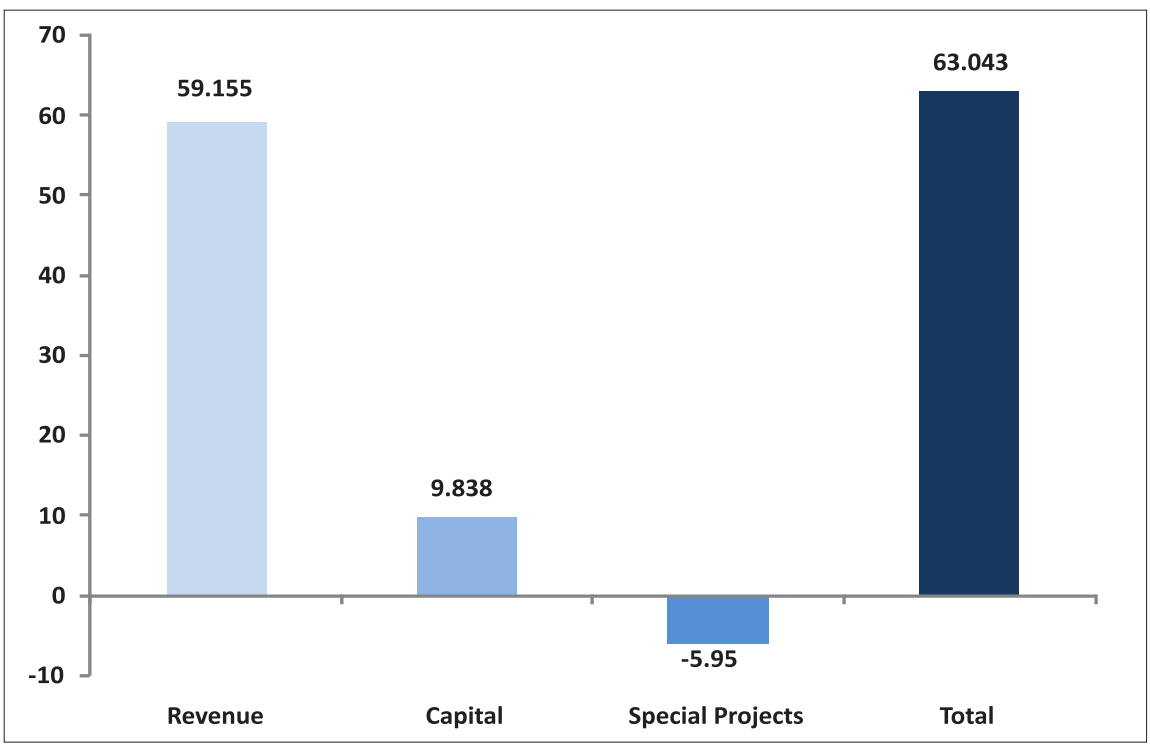
Lab Reserve (LR) Generation (2017-2018)

(Rs. in Lakh)

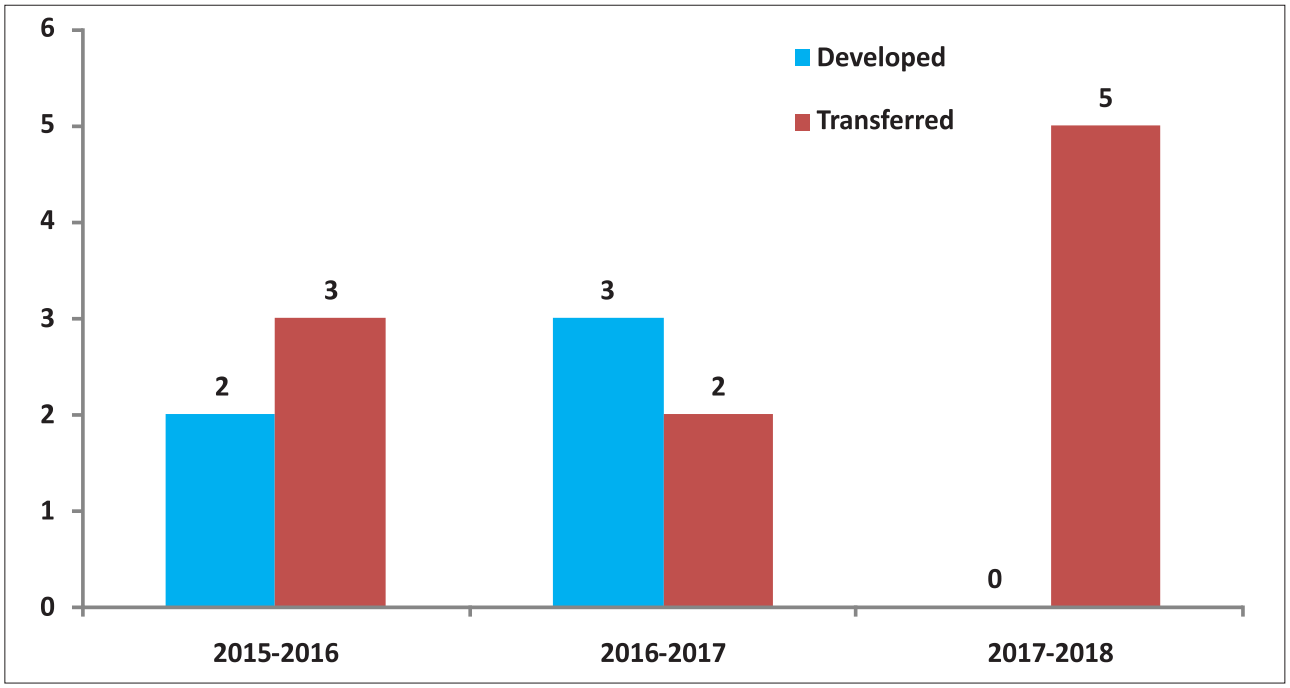


Expenditure out of LR (2017-2018)

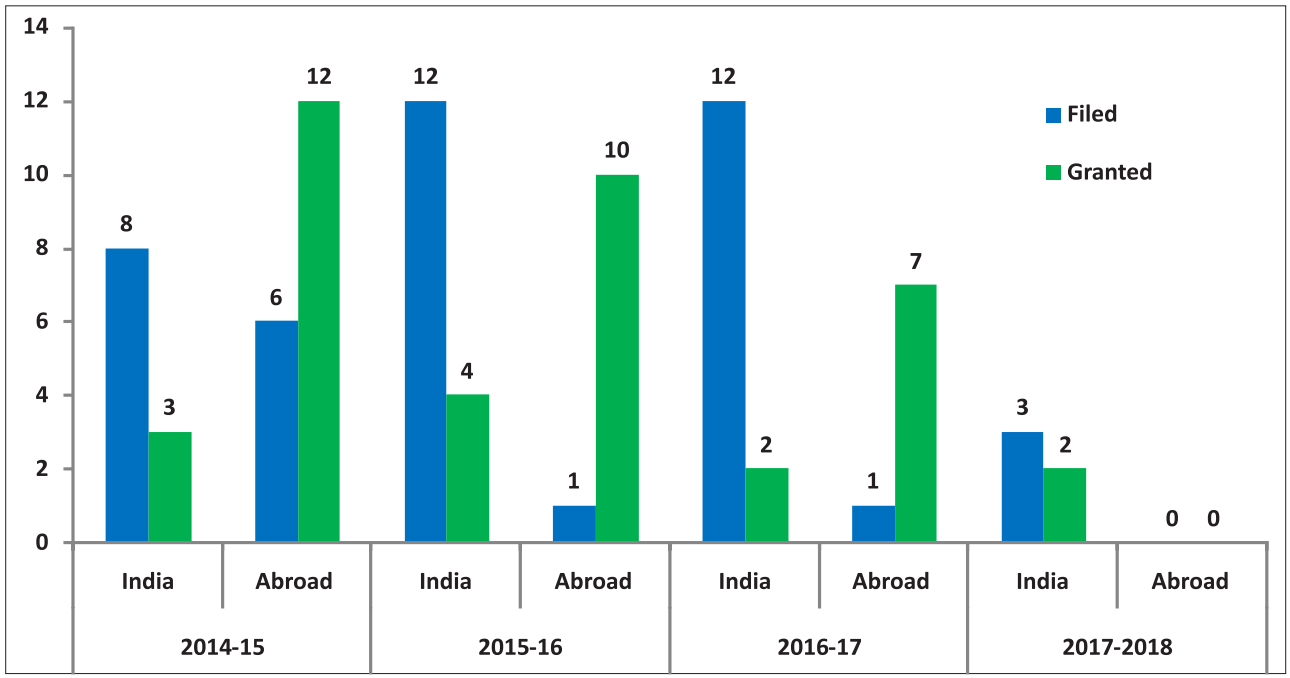
(Rs. in Lakh)



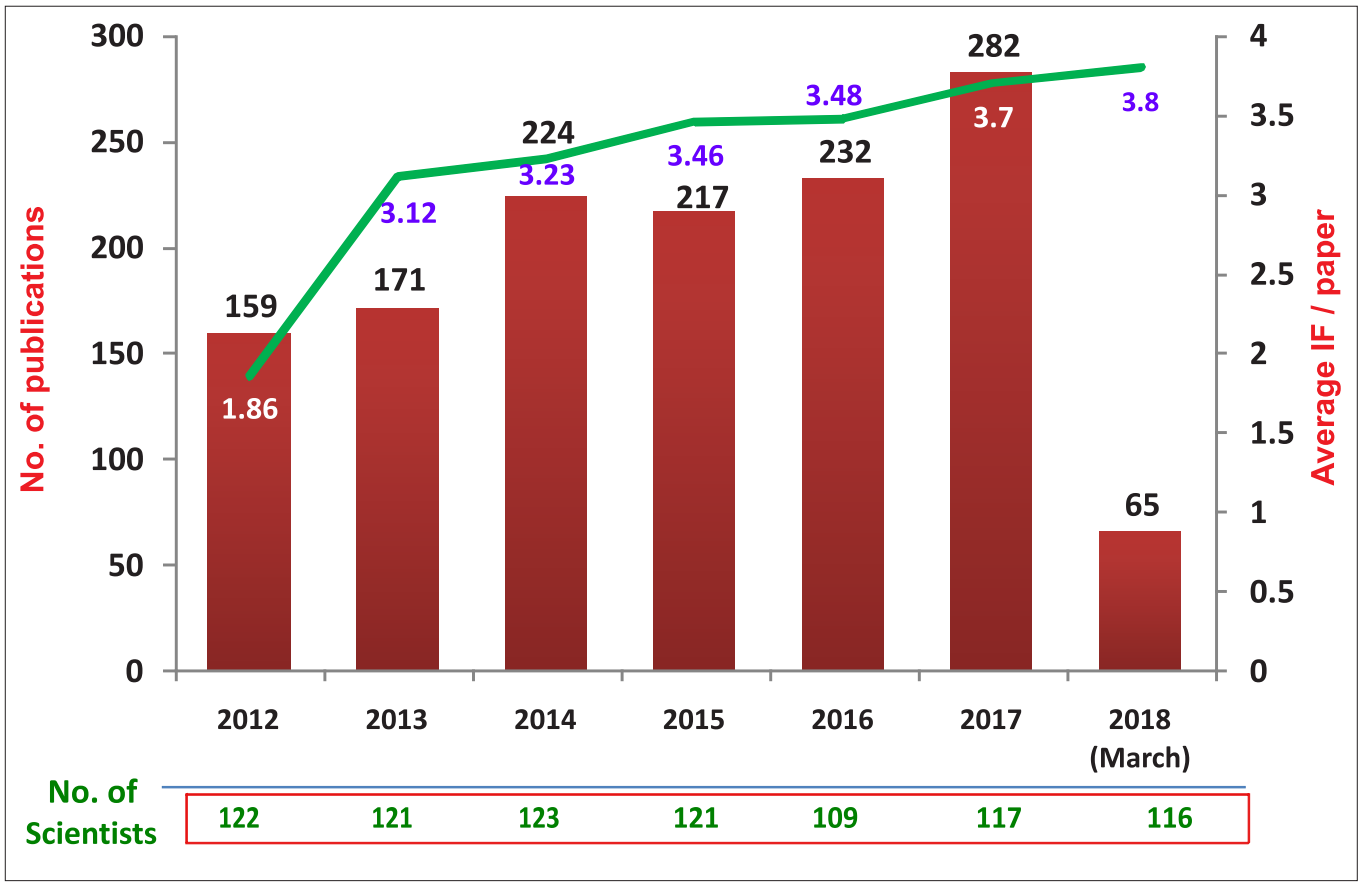
Technologies of CSIR-CECRI



CSIR-CECRI's Patents



No. of Publications and Average Impact Factor

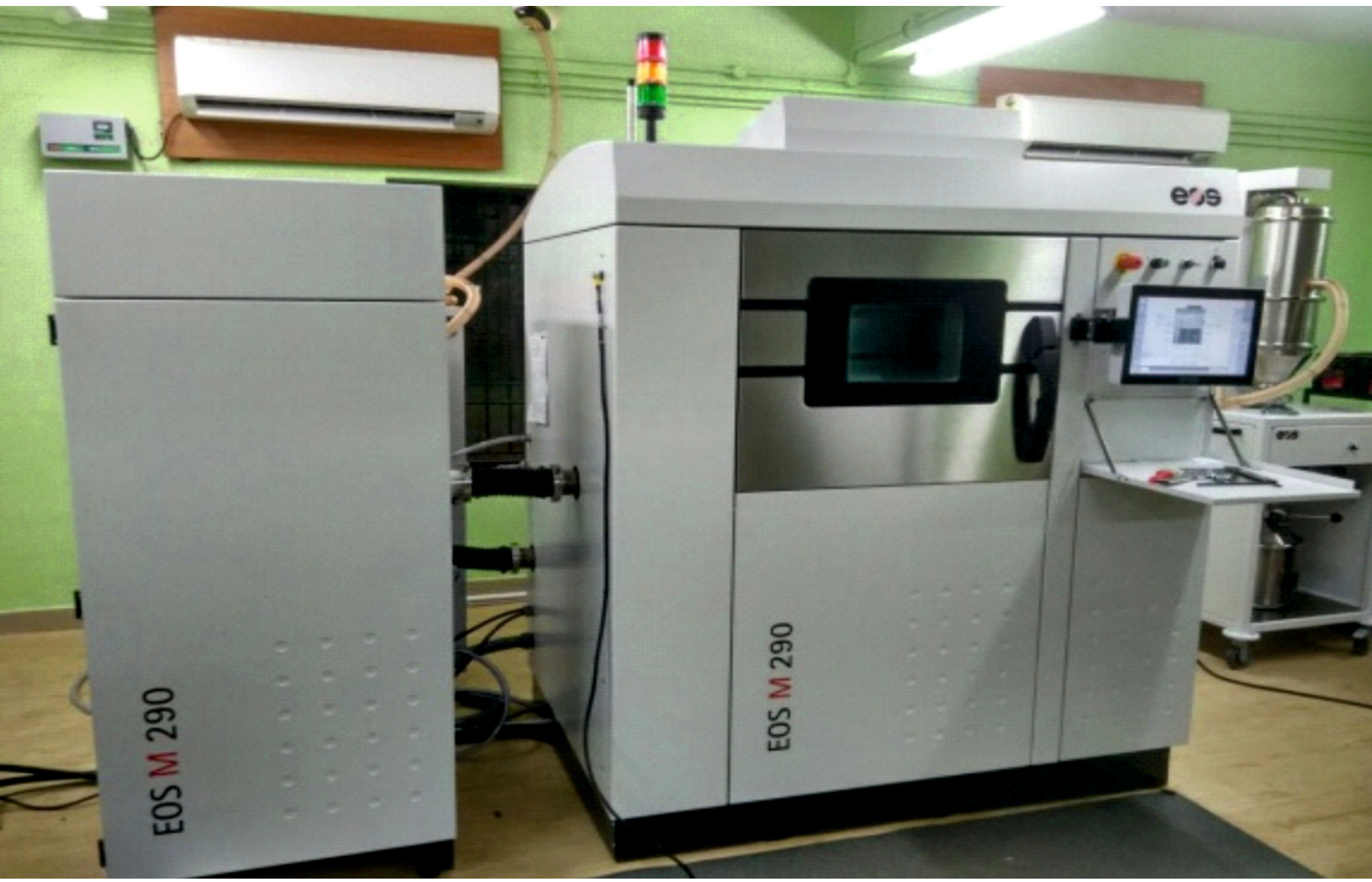




The 64th Research Council meeting (November 17, 2017)

Research & Development Reports...





3D Metal Printer (DMLS Technology)

MLP-0100

Development of zinc bromine redox flow battery (500 W)

Division(s) involved: Electrochemical Power Sources

PI: Dr. P. Ragupathy

Co-PI: Dr. S. Vengatesan

Funding agency: CSIR, New Delhi

Duration: 21.07.2016 to 20.07.2018

Budget (Rs. in Lakh): 79.00

Objectives

- To fabricate and demonstrate a fully functional well-engineered zinc- bromine redox flow battery stacks with capacity in range 250 - 500 W.

Highlights

- Assembled a 500 W capacity cell stack of zinc-bromine redox flow battery and tested
- Issues related to engineering aspects are being addressed

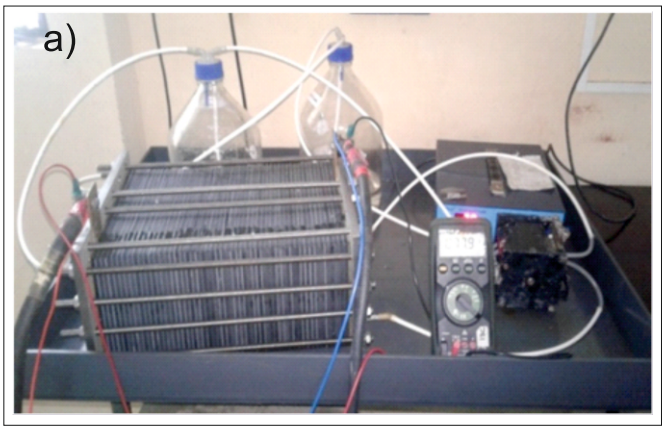
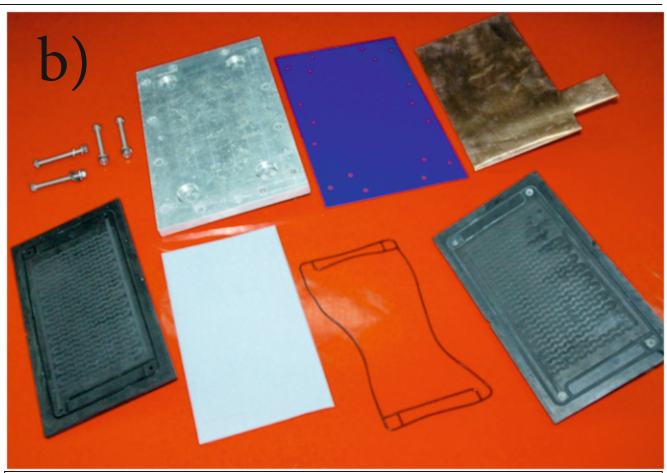
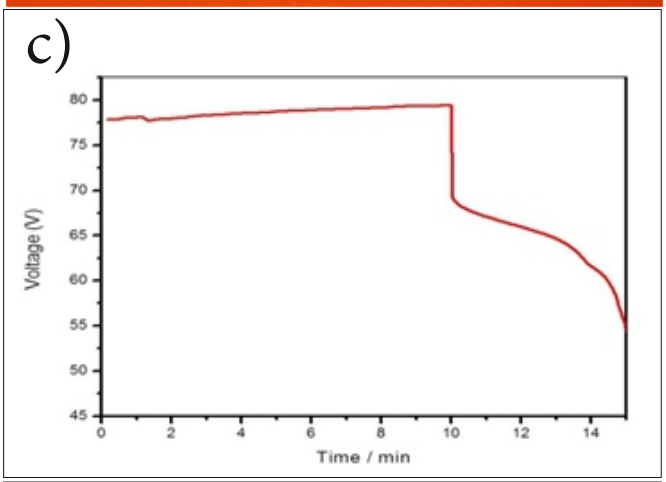


Figure. a) Zinc-bromine cell stack





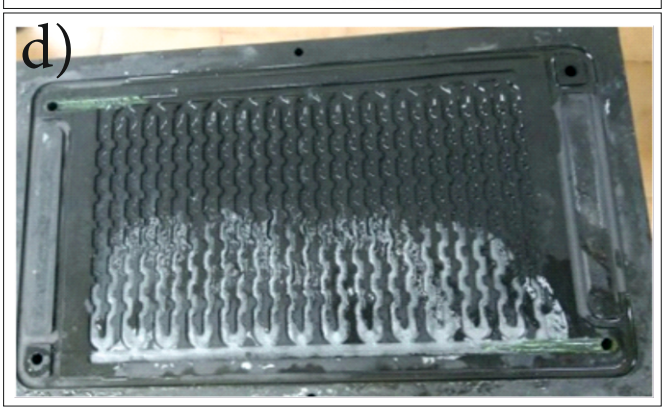


Figure. b) Cell components used to assemble the zinc bromine redox flow battery stack, c) charge-discharge curve, and d) electrodes after deposition of zinc. Non-uniform zinc deposition is noticed

MLP-0101

Electrochemical remediation of industrial effluents and recovery of chromium

Division(s) involved: Process Engineering & Corrosion and Materials Protection

PI: Dr. A. Manokaran

Co-PI: Dr. S. Maruthamuthu

Funding agency: CSIR, New Delhi

Duration: 16.08.2016 to 15.08.2018

Budget (Rs. in Lakh): 105.00

Objectives

- Chromium recovery from plating industrial effluent
- Salt separation from RO reject in textile industrial effluent

Highlights

- A 50 - 500 L/day electrochemical reactor based on the principle of electro-dissolution of iron to treat chrome plating industry effluent containing 200 - 2000 ppm Cr^{6+}
- A 500 - 1000 L/day electrochemical reactor based on the principle of electrooxidation to remove color and reduce COD
- Demonstrated this high capacity reactors at Perundurai Common Effluent Treatment Plant, Perundurai under real operation conditions over 100 hr.



Figure. An electrochemical reactor for the treatment of textile effluents

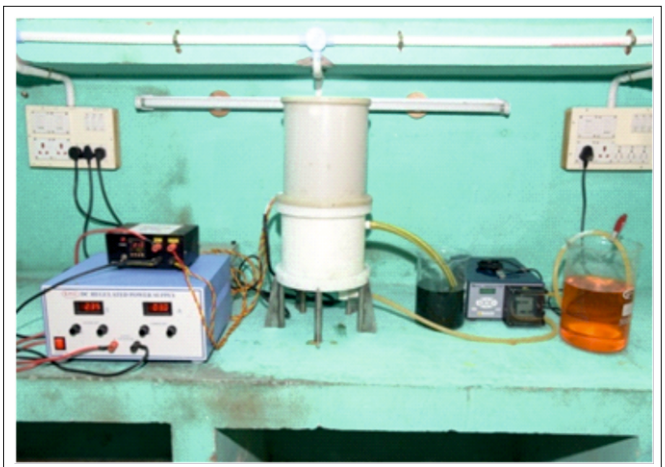


Figure. An electrochemical reactor for the treatment of plating industries effluents

MLP-0102

Development of accurate, reliable and cost effective sensor for the electrochemical detection of multiple analytes (Healthcare diagnostics and agricultural applications)

Division(s) involved: Electrodics and Electro-catalysis & Central Instrumentation Facility

PI: Dr. J. Mathiyarasu

Co-PI: Dr. V. Ganesh

Funding agency: CSIR, New Delhi

Duration: 23.09.2016 to 22.09.2018

Budget (Rs. in Lakh): 200.00

Objectives

To develop cost effective sensor systems for healthcare/environmental diagnostics and agricultural sector that includes:

- Farmer-friendly soil analysis kit for the estimation of N-P-K and pH
- Platform for the estimation of melamine and bisphenol-A in milk and environmental samples
- HbA1c/Glutathione determination and quantification for the development into a prototype device using screen-printed electrodes
- Futuristic development in parallel for the fabrication of flexible electrodes and electronics (epidermal analysis including sweat analysis)

Highlights

- Farmer-friendly hand-held soil testing kit - Fabricated and demonstrated a colorimetric/electrochemical based sensor kit for the estimation of N-P-K, electrical conductivity (EC) and pH by the farmer himself through a very simple approach. Using this, the farmers can assess the exact soil condition for planning the crop and fertilizer plan in a more effective and economic manner.

Demonstrated the soil testing kit to the farmers in the KISAN MELA-2018 held on 31st January, 2018 at CSIR-CIMAP, Lucknow. On the same occasion, the final version of the kit was released by Hon'ble Minister of State for Micro, Small and Medium Enterprises Shri. Giriraj Singh.



Figure. Demonstration of NPK soil testing kit at Kisan Mela



Figure. NPK soil testing kit

This meter is

- Capable of measuring soil pH, electrical conductivity, macronutrients - N, P & K, with the soil extract prepared onsite
- Works based on the colorimetric principle governed by Beer - Lambert's law for the estimation of pH, N, P and K
- Measures the electrical conductivity governed by the electrochemical principle
- Provides the color-based indication as Low, Medium, High & Excess levels of the NPK analyte

- Evaluated the fabricated melamine detection kit – Melamine (1,3,5-triazine-2,4,6-triamine, $C_3H_6N_6$), a triazine heterocyclic organic compound, widely used in the production of resins, flame retardants, fertilizer, etc. is being used as an adulterant as protein rich products in pet foods, milk and infant formula to increase the apparent protein content. The excess consumption of melamine adulterated products causes the development of kidney stones and other renal problems. A simple colorimetric methodology for the visual detection and determination of wide range of melamine (1 to 2000 ppm) concentrations in milk samples is developed. Silver (Ag) nanoparticles have been used to detect melamine products based on the change in the absorption spectrum of Ag nanoparticles.
- The developed melamine detection kit is under validation by Indian Institute of Food Processing Technology (IIFPT), Thanjavur, Tamil Nadu, India.



Figure. Optical melamine sensor

- Bisphenol-A detection- Bisphenol-A is one of the components released from plastics and contaminates the water. Elevated levels of bisphenol-A in humans are found to be responsible for several diseases including diabetic, blood pressure, obesity, cancer, etc. Electrochemical sensor based on modified glassy carbon (GC) electrodes with (a) Vulcan carbon XC 72 and (b) single-walled carbon nanotudes (SWCNT) and (c) nitrogen-incorporated GC electrode by electrochemical functionalization was developed to detect bisphonol-A in water as well as in urine samples. The nickel impurity present in the SWCNT was found to enhance the sensing of bisphenol-A without fouling the electrode as shown schematically below:

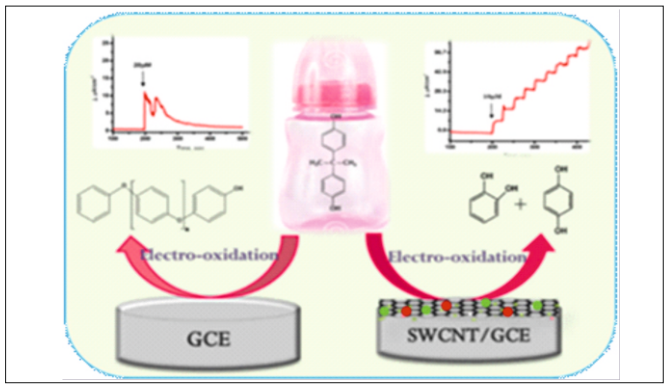


Figure. SWCNT modified GCE for sensing bisphenol-A in water samples (bottled water)

- This work is being carried out in collaboration with Apollo Reach Hospital, Managiri, Karaikudi, Tamil Nadu and urine samples collected from the hospital are being used for the estimation of bisphenol-A using above methodologies.
- Fabrication of flexible electrodes and electronics for sweat analysis - An array of carbon-based flexible sensor has been fabricated on a polyimide (PI) substrate using screen printing technique. The electrochemical behaviour of the flexible array electrode was established. The multianalyte patch developed for simultaneous monitoring of biomarkers from the blood samples. The red blood cells (RBC) can be separated from the whole blood using microfluidic channels and the total haemoglobin (Hb) and glycolated haemoglobin (HbA1c) can be quantified using electrochemical techniques. Also, other vital biomarkers such as glucose and cholesterol can be quantitatively monitored from the plasma samples.

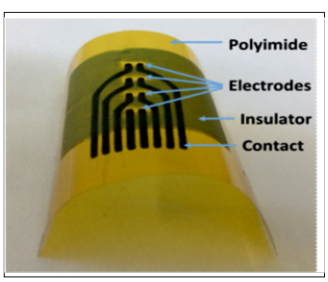


Figure. Flexible carbon-based sensor developed for sweat analysis

MLP-0103

Development of high temperature resistant ceramic thermal barrier coatings for missile components

Division(s) involved: Electroplating and Metal Finishing, Materials Electrochemistry & Corrosion and Materials Protection

PI: Dr. G. Sreedhar

Co-PI: Dr. N. Lakshminarasimhan

Funding agency: CSIR, New Delhi

Duration: 23.09.2016 to 22.09.2018

Budget (Rs. in Lakh): 104.00

Objectives

- To develop multi-layered TBCs using electroplating and plasma spray processes
- To demonstrate the temperature difference (T) in the range of 250 -500 °C
- To obtain the surface roughness of TBCs at around 3 m

Highlights

- Developed multi-layered TBCs using electroplating and plasma spray processes
- Achieved the T of ~250 °C at an operational temperature of 850 °C
- Optimized the surface roughness of TBCs to ~3 m
- Demonstrated the demonstrated TBCs to the team of RCI, Hyderabad

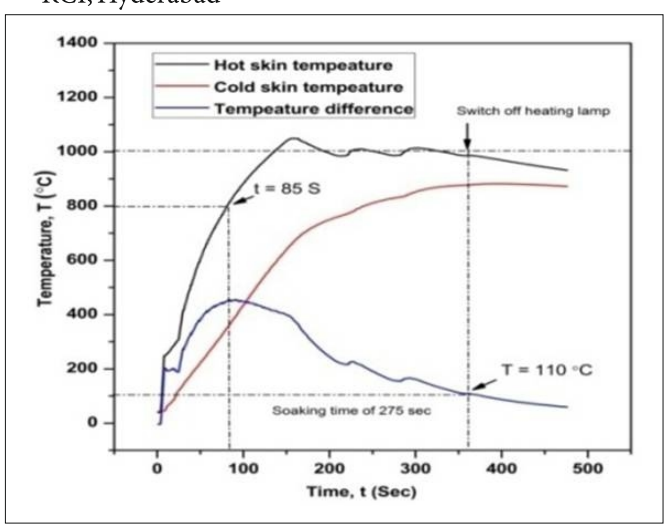


Figure. Thermal shock behaviour of 800-900 m thick multi-layered TBCs at 1000°C

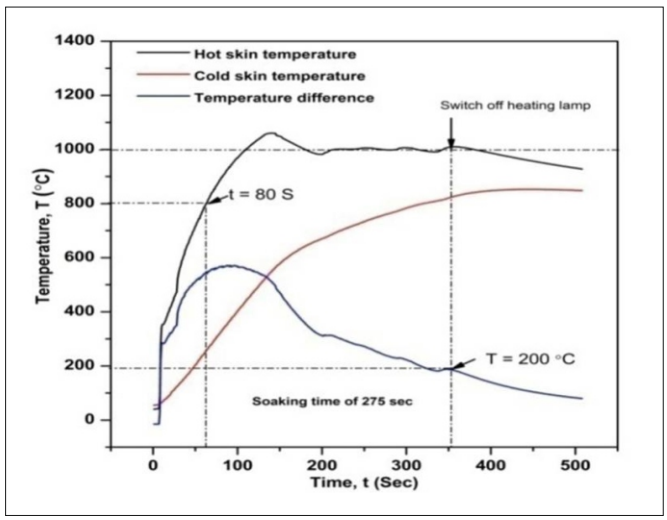


Figure. Thermal shock behaviour of 1.5 mm thick multi-layered TBCs at 1000 °C

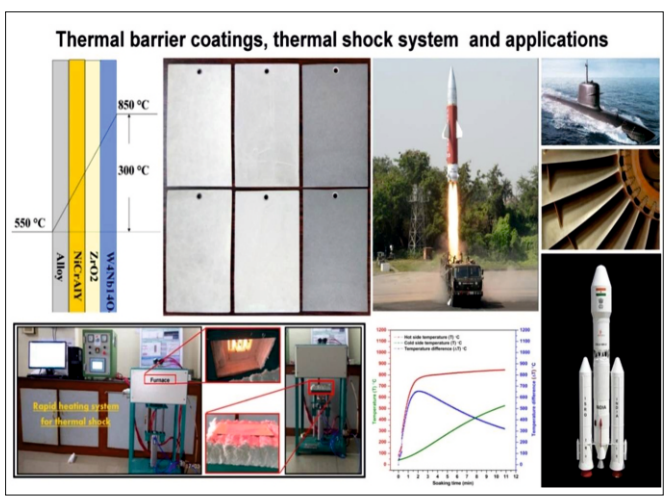


Figure. Scheme of TBCs, thermal shock measuring system and applications

IHP-0089

Design and development of graphitic carbon nitride and its composites for electrochemical, photoelectrochemical and photocatalytic applications

Division(s) involved: Materials Electrochemistry

PI: Dr. N. Lakshminarasimhan

Funding agency: CSIR, New Delhi, Under Young Scientist Award Scheme

Duration: 12.06.2013 to 11.06.2018

Budget (Rs. in Lakh): 25.00

Objectives

- Focuses on the design and development of graphitic carbon nitride (g-C_3N_4) and its composites with metal nanoparticles and/or metal oxides for their electrochemical, photoelectrochemical and photocatalytic applications

Highlights

- First observation of metachromasy of methylene blue dye due to aggregation over phosphate-modified polymeric carbon nitride
- New blue pigment based on organic-inorganic hybrid with (L, a, b) colour parameters of (66.245, -1.729 and -15.565)
- Photocatalytic and electrochemical properties of synthesized g-C_3N_4 and its nanocomposite with TiO_2, $BiPO_4$, and bismuth hexacyanoferrate(III) [BiHCF(III)]
- Photocatalytic H_2 production using g-C_3N_4/TiO_2/Pt with different conditions of photodeposition of Pt co-catalyst

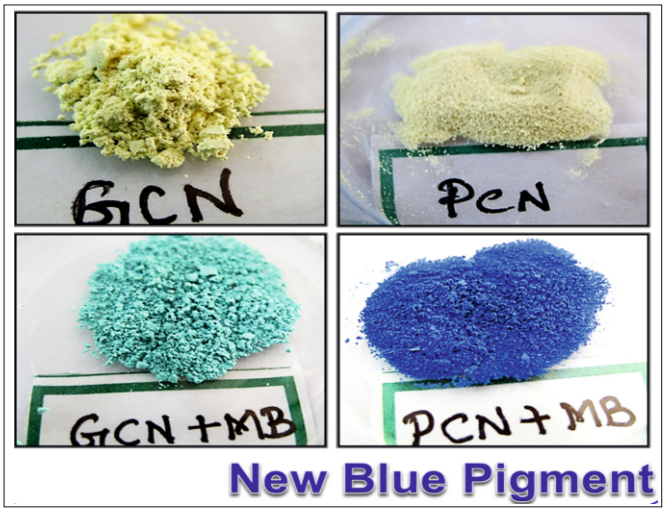


Figure. Photographs of GCN, PCN, GCN+MB and PCN+MB samples showing their different colours

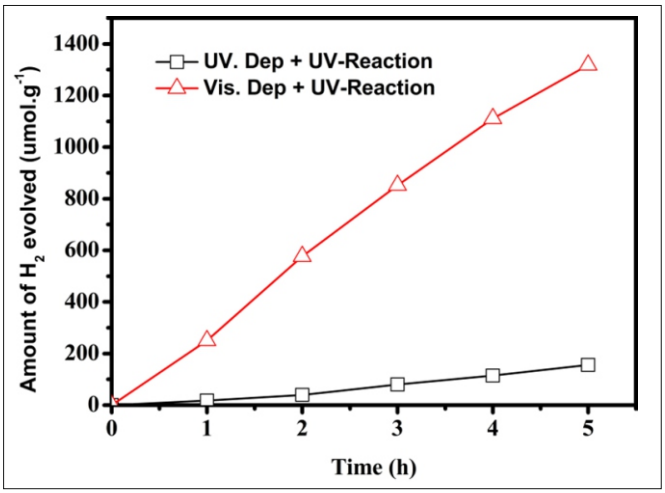


Figure. Time course of H_2 evolution under UV irradiation for Pt deposition under UV and visible light irradiation. [Cat.] = 1 g/L, Pt = 0.1 wt.% and TEOA 10 vol.%

IHP-0094

Human sweat and saliva analyses– Electrochemical perspectives

Division(s) involved: Electrodics and Electrocatalysis

PI: Dr. V. Ganesh

Funding agency: CSIR, New Delhi, Under Young Scientist Award Scheme

Duration: 01.09.2015 to 31.08.2020

Budget (Rs. in Lakh): 25.00

Objectives

- To explore the use of human sweat and saliva as unconventional electrolytic medium for investigating the electrochemical concepts
- To employ flexible materials such as plastics, papers, and fabrics as electrode materials for developing electrochemical biosensors for the detection of specific analytes present in human sweat and saliva
- To fabricate nano/micro ensembles (arrays) of the electrode on such flexible electrode materials and investigate their applications as wearable electrochemical biosensors
- To investigate and analyze the conventional electrochemical concepts and techniques by using unconventional electrolytes such as sweat and saliva by comparing it with solid (GC, Au, and Pt) and microelectrodes
- To develop simple, affordable and selective electrochemical biosensors for lactate, urea, and glucose present in sweat and saliva

Highlights

- Utilized the artificially simulated human sweat and saliva as unconventional electrolytes to investigate the electron transfer reactions of a redox probe
- Determined the parameters associated with electron transfer reaction kinetics of a redox probe in such unconventional electrolytes using cyclic voltammetric and electrochemical impedance spectroscopic techniques
- Correlation of results with the development of electrochemical biosensors of analytes present in human sweat and saliva
- Developed a simple methodology to utilize overhead projector (OHP) sheets as a flexible electrode material for the analysis and investigation of electrochemical techniques through chemical and electrochemical modification strategies
- Structural and morphological characterization of such chemically modified flexible OHP sheets using microscopic and spectroscopic techniques
- Fabrication of electrochemical biosensor for the detection of lactate in artificially simulated human sweat using such chemically modified flexible strips

GAP-02/13

Optofluidic detection of air and liquid flow inside microchannels

Division(s): Electroplating and Metal Finishing

PI: Dr. A. Edward Peter (Inspire Faculty)

Mentor: Dr. Sundar Mayavan

Funding agency: DST, New Delhi

Duration : 01.03.2013 to 29.02.2018

Budget (Rs. in Lakh): 86.27

Objectives

- To design of an optofluidic air pressure and liquid flow sensor
- To study the optofluidic sensor under different types of fluids and air pressure
- To develop a model for the proposed optofluidic sensor and simulate the equations using computer programming

Highlights

- Detection of cracks on the surface of thin films and coatings using optofluidic technique has been shown
- Designed and fabricated samples for optofluidic pressure and temperature sensors in applications to robotics, bionic muscles and touchscreen. Experiments have been completed and the patent filing is under process
- Developed a new experimental setup to study the above samples and an external electronic circuit for measurement and automation, and an on-screen analysis of the data
- Completed the work on "generation of aspherical optical lenses via arrested spreading and pinching of a crosslinkable liquid"
- A patent based on the work on "an optical lens, lens filter and preparation thereof" has been filed. These lenses are useful for our optofluidic detection techniques
- A patent on "a method of preparation aspheric optical lenses and their applications"
- Designed and developed a high-frequency electromagnetic relay switching circuit for the fabrication of a new model micro pumping device.
- Designed and developed drives for the hybrid stepper motor and DC motor using ATMEL 89S51 microcontroller for microfluidic pumping mechanism.
- Optofluidic sensors to detect fluid flow inside microchannels

This work includes the design and fabrication of a new optofluidic device to detect the liquid flow inside microchannels embedded inside PDMS network.

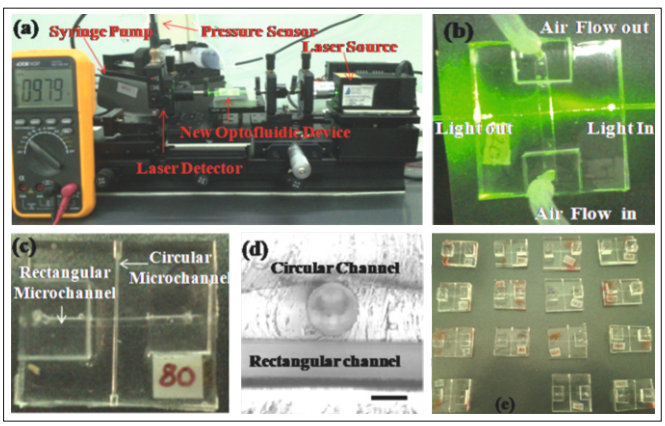


Figure. (a) Experimental Setup (b) light flow and fluid flow channels in an optofluidic experiment (c) new optofluidic device with circular and rectangular microchannels separated by a known distance of 80 microns (d) microscopic cross-sectional view of the sample showing the separation between the circular and rectangular channel. The scale bar represents 100 microns (e) samples with different interchannel spacing varying from 10 microns to 160 microns

New optofluidic tactile sensor to detect a crack in thin films and paint coatings

3-D integrated Optofluidic channel network to detect pressure and temperature for bionic applications

Fabricated PDMS film embedded with a subsurface Optofluidic microchannel 3D network of optofluidic microchannels for load and temperature measurement

New optofluidic tactile sensor to detect a crack in thin films and paint coatings

3-D integrated Optofluidic channel network to detect pressure and temperature for bionic applications

Fabricated PDMS film embedded with a subsurface

This work presented a new force/tactile sensor using optofluidic microchannels filled with light waveguide embedded inside the PDMS subsurface.

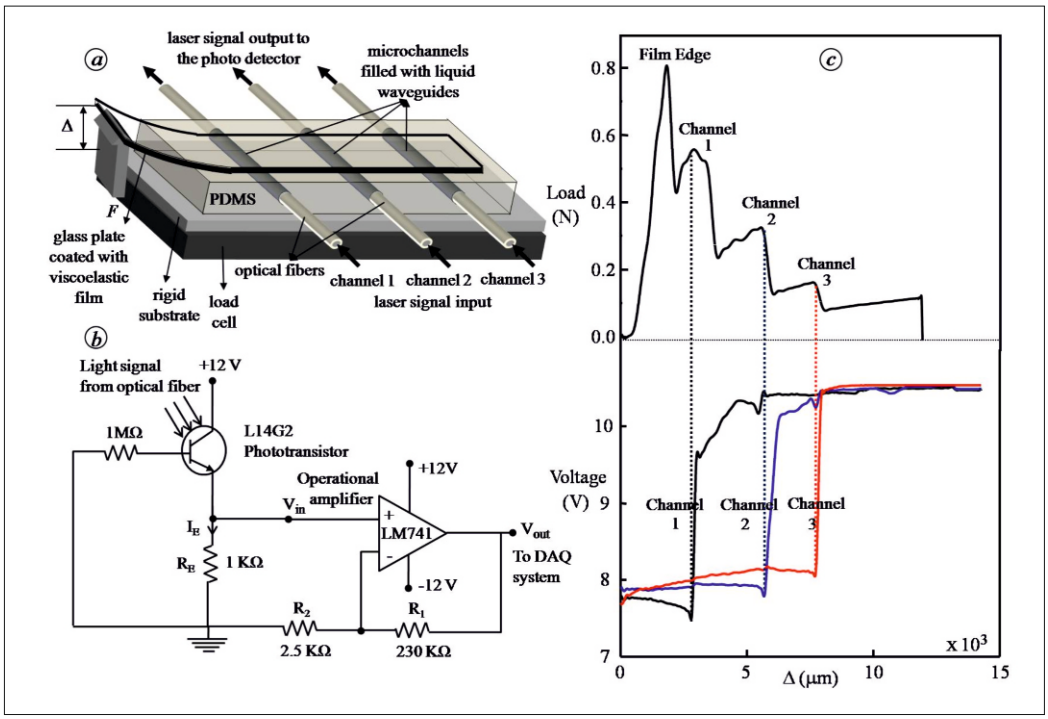


Figure. (a) Schematic diagram of the experiment, in which a glass plate coated with viscoelastic adhesive is peeled from the PDMS film embedded with Optofluidic microchannels, which remains strongly bonded to a rigid substrate. (b) Circuit design to convert light signal to voltage signal using a phototransistor and operational amplifier (c) Force vs. displacement plots obtained in a displacement controlled peeling experiment and the corresponding voltage change at the vicinity of each channel when the glass plate with adhesive coating was separated from the optofluidic sensor surface

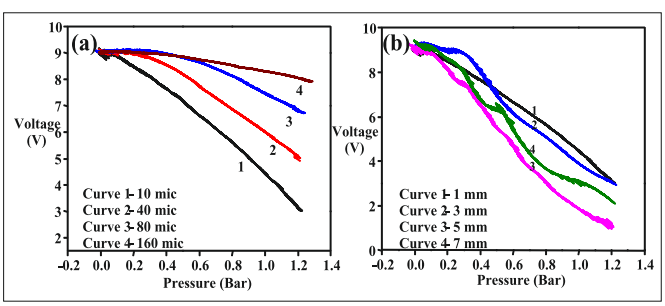


Figure. (a) Voltage vs. pressure plot for different interchannel spacing. Samples with interchannel spacing was varied from 10 μm to 160 μm. (b) Voltage vs. pressure plot for different width of the channel. Samples with the width of the rectangular channel was varied from 1mm to 7mm

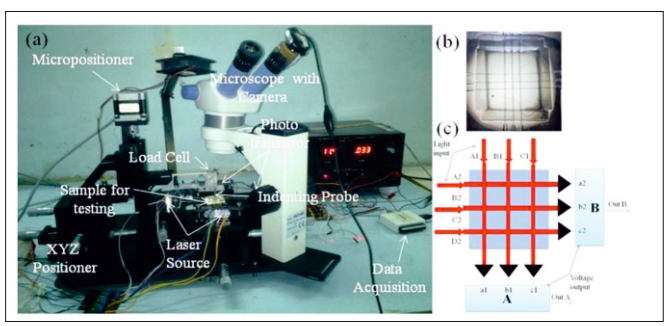


Figure. (a) Experimental setup (b) and (c) array of the optofluidic channel and the measurement of optical signal transmission

Generation of aspherical optical lenses via arrested spreading and pinching of a cross-linkable liquid

A novel method of producing high quality aspherical optical lenses by using simultaneous spreading and crosslinking of a sessile drop of polymeric liquid on a chemically modified substrate have been presented.

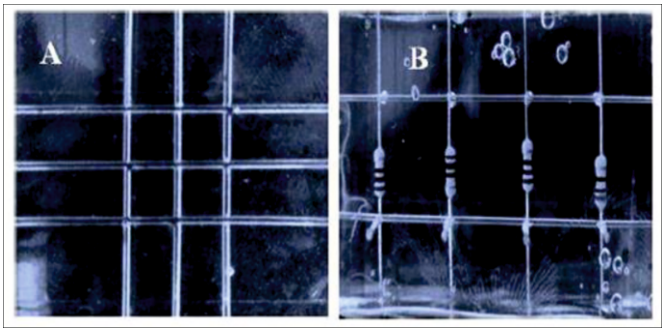


Figure. (A) 3D Array of the optofluidic channel for load sensor and (B) optofluidic temperature sensor embedded with micro-heaters for sensor characterization

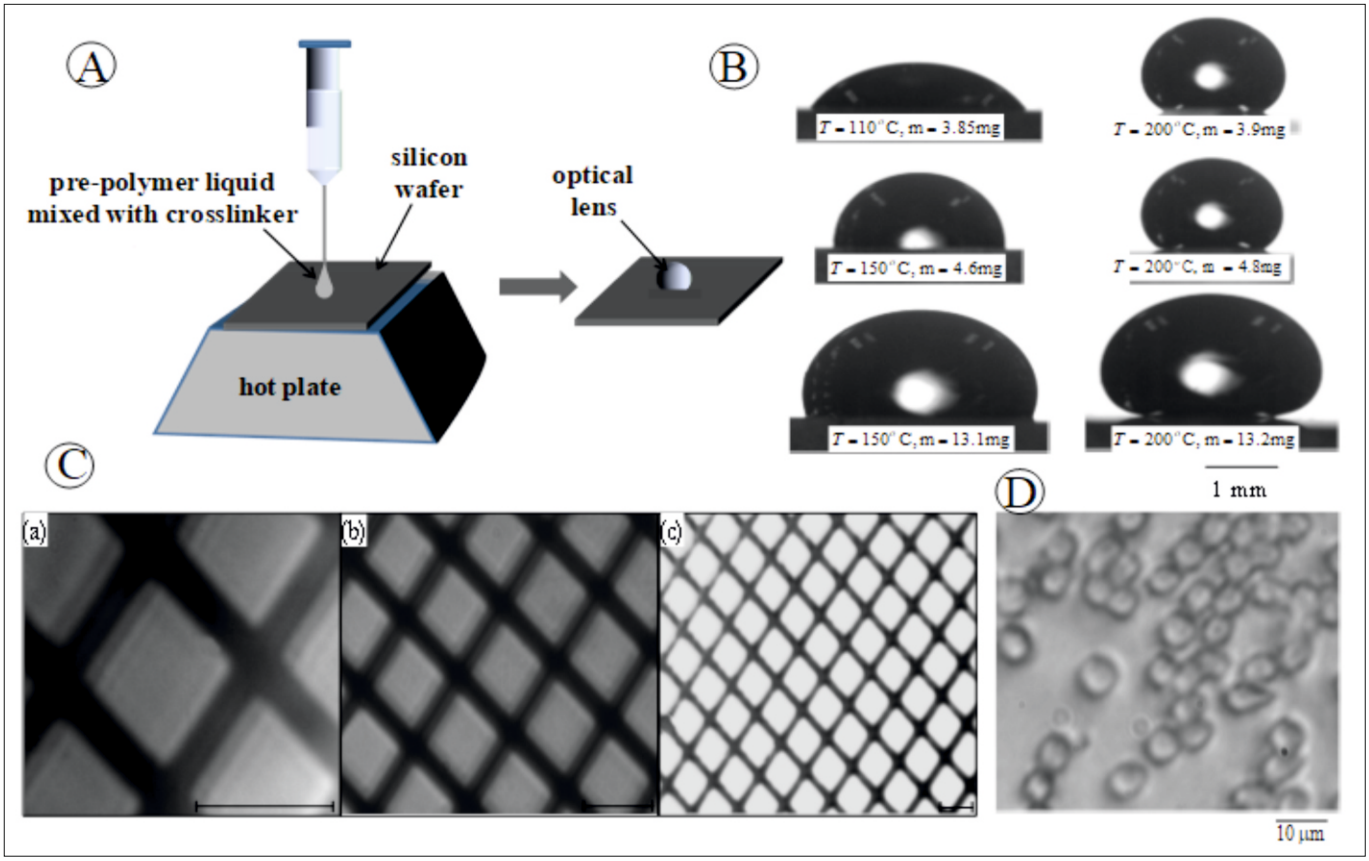


Figure. (A) Schematic of the fabrication process in which the pre-polymer liquid Sylgard 184 elastomer mixed with a curing agent is released from a syringe onto an optically smooth surface placed on a hot plate. The liquid in contact with the hot substrate crosslink within a very small time (B) The figure shows the optical micrographs of lenses prepared in the method described in figure, in which a silicon wafer coated with octadecyltrichlorosilane molecules was used as the substrate; the substrate was preheated to T=110-200 ^{0}C before releasing the cross-linkable liquid onto it. The different quantity of the pre-cross-linked liquid was used for generating these lenses. The figure demonstrates that the maximum radius of curvature of the lenses can be tuned by varying both the temperature of the substrate and the quantity of the liquid. (C) A TEM grid was used as an object for visualizing under different lenses prepared above. The lenses corresponding to images (a) – (c) have a maximum radius of curvature k^{-1}_{max} = 0.46,1.43, 2.5 mm respectively. The scale bar in each figure represents 25 m. This figure demonstrates that optical lenses of different magnification can be prepared by the proposed method. (D) The figure shows human red blood cells which are known to be of 6 m in diameter. The specific image is captured by a lens of principle radius of curvature k^{-1}_{max} = 0.46,1.43, 2.5 and fitted to a CCD camera. This figure demonstrates that the lenses can be used for imaging biological samples

GAP-18/13

Electrochemiluminescence of metal clusters: Synthesis, characterization and suitable for environmental applications

Division(s): Electrodics and Electrocatalysis

PI: Dr. S. Senthil Kumar

Funding agency: DST, New Delhi

Duration: 07.11.2013 to 06.11.2017

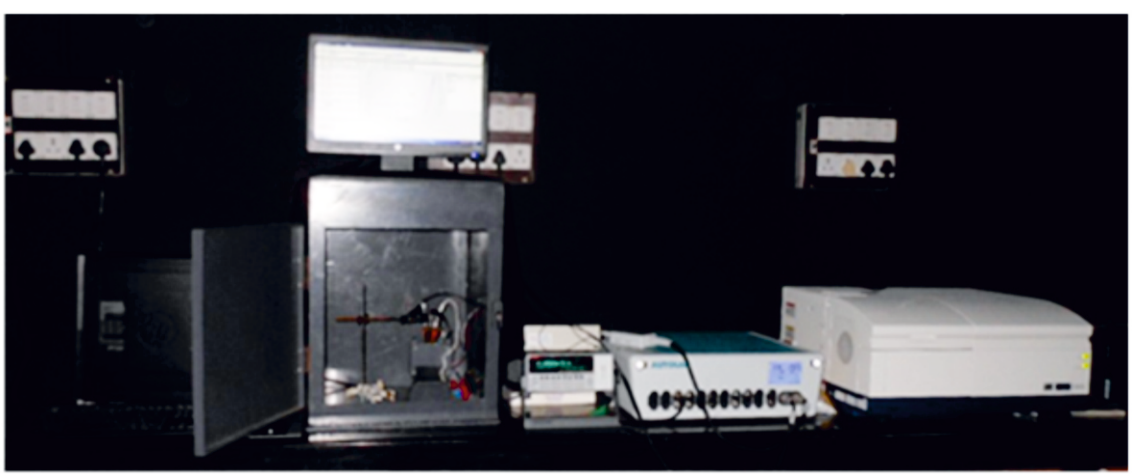
Budget (Rs. in Lakh): 44.47

Objectives

- To develop novel synthetic protocols for preparing noble metal clusters by chemical and electrochemical methods
- To elucidate the possible mechanism of electron transfer annihilation of electrogenerated anion and cation radicals from metal clusters *via* inter- and intra-band transitions in the HOMO-LUMO gap or metal clusters with suitable stabilizer (act as electron donor or acceptor or redox active co-reactant) in ECL electrode platform
- Finally, design simple fabrication of metal cluster-based ECL electrode assembly to improve the ECL intensity and thereby enhance the selectivity and sensitivity of analyte molecule to an extent approaching zepto-molar levels and possibly single-molecule detection

Highlights

- Assembly of a home-made ECL step-up by using various components such as photo multiplayer tube (PMT), high voltage amplifier and pico-ampere level sensitivity of potentiostat with ADC controller
- Unique feature of the assembled ECL instruments for studying not only ECL-based sensor applications but also to understand the fundamental concept and physico-chemical properties of light producing molecules and nanostructured quantum dots
- ECL studies using $Ru(bpy)_3^{2+}$-tripropylamine (TPrA) system in oxygen saturated neutral PBS at 0.05 V/s. The effect of different atmospheric conditions, pH and electrode surface studies confirmed that nanoporous gold (NPG) has more MMS atoms or active sites than AuNPs and pc-Au electrodes which are more responsible to produce more ROS and unusual ECL signals at -0.2 and 0.32 V. These unusual ECL peak intensities on NPG are linearly increasing with various time intervals of oxygen gas purging in PBS (*p*H 7.4). These kinds of more sensitive and selective unusual ECL peaks on NPG are more useful in identifying the active sites or MMS atoms on NPG and to design the biosensor platforms for health care applications.



Unique custom designed ECL setup at CECRI

GAP-08/14

Synthesis, physical and biological applications of supra and super-molecules

Division(s): Electro Organic

PI: Dr. M. Kathiresan

Co-PI: Dr. D. Velayutham

Funding agency: DST, New Delhi

Duration: 03.03.2014 to 02.03. 2019

Budget (Rs. in Lakh): 35.00

Objectives

- To develop new charge/electron storage devices, synthesis of single molecular wires that have to conduct or show rectifying behavior
- To develop new synthetic methodology for the synthesis of supramolecular architectures
- To understand the molecule-molecule interactions that will lead to several photophysical and biological applications.

Highlights

- Constructed a 2D reversible supramolecular organic framework from viologen guest molecules and CB[8] that will have potential applications in the field of drug delivery systems
- The mechanism of self-assembly is: (i) strong stacking of viologen radical cations (V^{+}) in aqueous/phosphate buffer solution containing excess of sodium dithionite, (ii) the dimerized species $(V^{+})_2$ can be included in to hydrophobic cavity of CB[8] which additionally stabilizes the $(V^{+})_2$species
- UV-Vis investigation clearly proves that the radical cations were involved in intermolecular dimerization and the dimerized species were encapsulated into CB[8] cavity
- In addition, it was demonstrated that these supramolecular organic frameworks can be depolymerized by oxidation in air and again can be polymerized (intermolecular radical dimerization) by reduction under an inert atmosphere. Such reversible systems are of broad interest as they show advantages over irreversible systems
- A key point of these newly–assembled processes are the high stability of radical cations with the formation of larger aggregates leading to the formation of 2D assembly as indicated by TEM. Small angle X-ray scattering (SAXs) profile of the supramolecular polymer samples showed broad scattering peaks indicating the internal periodicity of the supramolecular polymer. Thus, the dimerization of radical cations can be considered as a new strong non-covalent force to construct highly ordered supramolecular ensembles for a wide range of applications.
- Future studies will focus on the photophysical and spectroelectrochemical investigations on these systems towards reversible electron/charge storage properties.

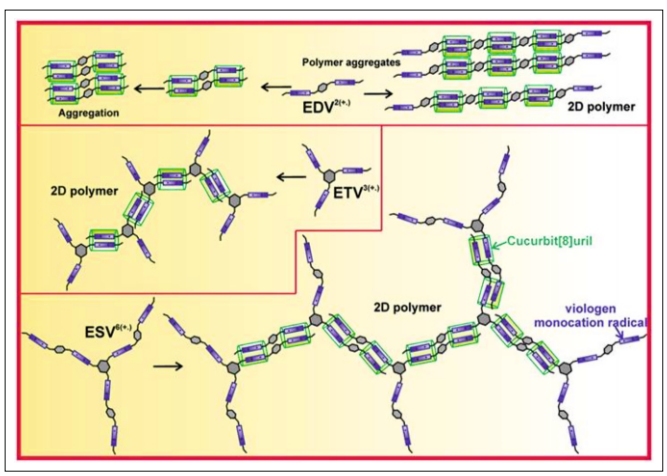


Figure. Scheme depicting the supramolecular self-assembly process involved in EDV, ETV, and ESV

GAP-01/15

Enhancement of biomineralization with osteoblast cells on biodegradable Mg-based amorphous alloy coated a metallic/polymeric substrate for orthopedic implants

Division(s): Materials Electrochemistry

PI: Dr. B. Subramanian

Co-PI: Dr. S. Maruthamuthu

Funding agency: DST-SERB, New Delhi

Duration: 20.05.2015 to 19.05.2018

Budget (Rs. in Lakh): 36.65

Objectives

- To develop biodegradable Mg-based amorphous alloy coatings on metals/polymers using physical vapor deposition methods like reactive magnetron sputtering.
- To evaluate the mechanical properties, such as elasticity, hardness, toughness of the developed coatings, etc.
- To do *in-vitro* corrosion studies in simulated body fluid
- To study the biological compatibility of the metallic glass coatings including *in-vitro* and *in-vivo* investigations including intramuscular implantation
- To investigate the microbes interactions with metallic glass coated implants and to investigate after intramuscular implantation
- The adhesion and proliferation of osteoblasts cells on metallic glass coated metal/ polymer surface will be evaluated

Highlights

- Developed Mg based metallic glasses that can be used as bio-implant material owing to its osseointegration property and biocompatible nature
- Biodegradable $Mg_{60}Zn_{35}Ca_5$ thin film metallic glasses (MgMG) over metal and PCL scaffolds have been fabricated and their biocompatible, hemocompatible and biodegradable behavior were studied along with their structural properties
- Mg-based TFMG show increased corrosion potential compared to pure Mg sample. The hemolysis rates of Mg-Zn-Ca TFMG are quite low (<0.05%), which are far below the safe value of 0.1%, suggesting that the coating would not lead to severe hemolysis according to ISO 10993–4:2002.
- The morphologies of blood cells on uncoated SS and Mg-based TFMG also show the hemocompatibility.
- The calcium assay showed that the Saos-2 cells grown and differentiated on the control TCPS surface and the TFMG coated surface had higher mineral level compared to undifferentiated TCPS
- ALP content is an important factor in the bone mineral formation and shows a scale of changes during differentiation. Mg-based metallic glass showed elevated alkaline phosphatase levels in comparison to TCPS controls suggesting cells in maturation phase.

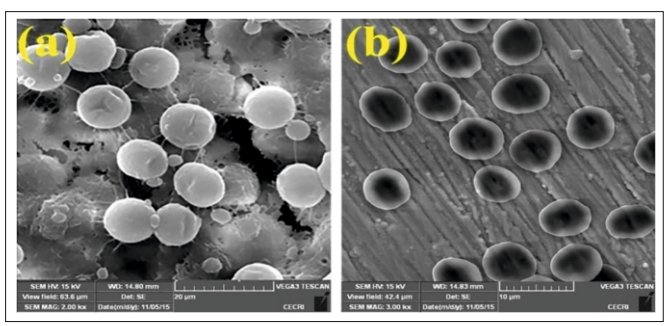


Figure. Hemocompatibility for $Mg_{60}Zn_{35}Ca_5$ TFMG

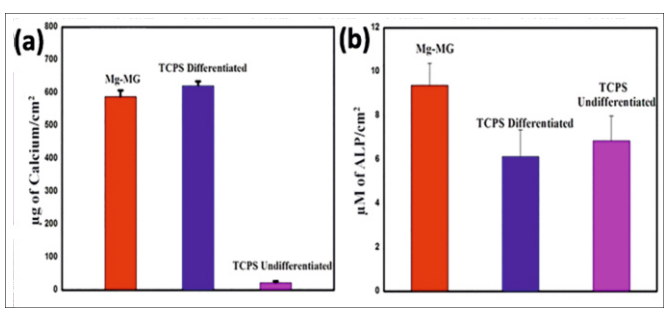


Figure. Biomineralization studies (a) calcium assay and (b) ALP assay

GAP-11/15

Synthesis of nano-scale architectures: Study and evaluation of their photophysical and electronic applications

Division(s): Electro Organic

PI: Dr. M. Kathiresan

Co-PI: Dr. D. Velayutham

Funding agency: DST-SERB, New Delhi

Duration: 01.09.2015 to 31.08.2018

Budget (Rs. in Lakh): 24.54

Objectives

- Synthesis of porous organic polymers, characterization and their application as electrocatalysts and in chemical catalysis
- To synthesize viologen-based nanoscale architectures and investigation on their electrochromic behavior. The aim is to enhance the radical lifetime towards electrochromism by means of supramolecular interactions

Highlights

- Porous organic polymers comprising of triazine and ethylenediamine (EPOP) were synthesized and characterized
- The as-synthesized sample was carbonized at different temperatures and its catalytic activity towards the reduction of 4-nitrophenol (4-NP) and electrocatalytic activity towards oxygen evolution reaction was evaluated.
- The sample carbonized at 700 °C showed a better catalytic activity towards OER and sample carbonized at 800 °C showed a better catalytic activity towards 4-NP reduction

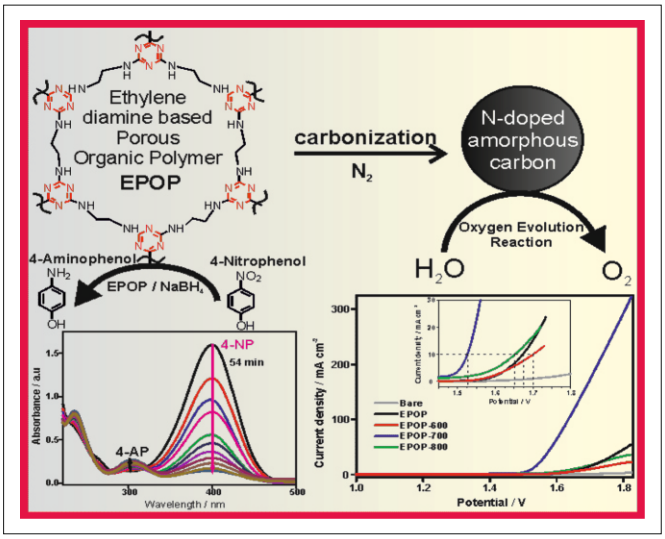


Figure. Scheme showing the synthesis of EPOP samples and their catalytic activity

- Synthesized viologen oligomers comprising of 1, 2 and 3 viologen units separated by a butyl spacer. These viologen pendants bear a dodecyl end group which renders poor solubility in both organic and aqueous media. Hence, synthesis of oligoviologens comprising of 1 to 5 viologen units separated by a butyl spacer and ethyl end groups is under progress.
- Oligoviologen comprising of 1, 2 and 3 viologen units were synthesized and synthesis of 4 and 5 are in progress.
- Host molecules cucurbit[8]uril and cucurbit[7]uril have been synthesized in a large scale and will be used for guest-host interaction studies. Further, the method will be optimized at a certain host-guest ratio to enhance the electrochromic behavior of the guest viologen compound.

GAP-14/15

Solid state batteries for consumer electronics and ELVs

Division(s): Materials Electrochemistry & CECRI Chennai Unit

PI: Dr. M. Sathish

Co-PI: Dr. D. Jeyakumar and Dr. K. Ramesha

Funding agency: Ministry of Heavy Industries, New Delhi

Duration: 11.11.2015 to 31.03.2018

Budget (Rs. in Lakh): 334.73

Objectives

- Identification and optimization of suitable lithium ion conducting glass compositions that will enable the formation of cubic LLZO at lower temperatures
- Optimization of slurry formation to enable very thin pinhole-free membrane

Highlights

- Optimized slurry formation to enable very thin, pinhole-free membrane with different thicknesses and sizes
- Development of solid state electrolyte in combination with a glass (or) flux and cathode materials that maximizes density and, electronic and ionic conductivity
- Developed LLZO-based solid state electrolyte with the conductivity in the range of 4 X 10^{-4} S/cm and with optimum thickness
- Fabricated LCO cathode composite electrode as the ion conducting matrix in addition to the conventional carbon and PVDF additives
- Demonstrated the all solid state cell and its charge-discharge ability for several cycles

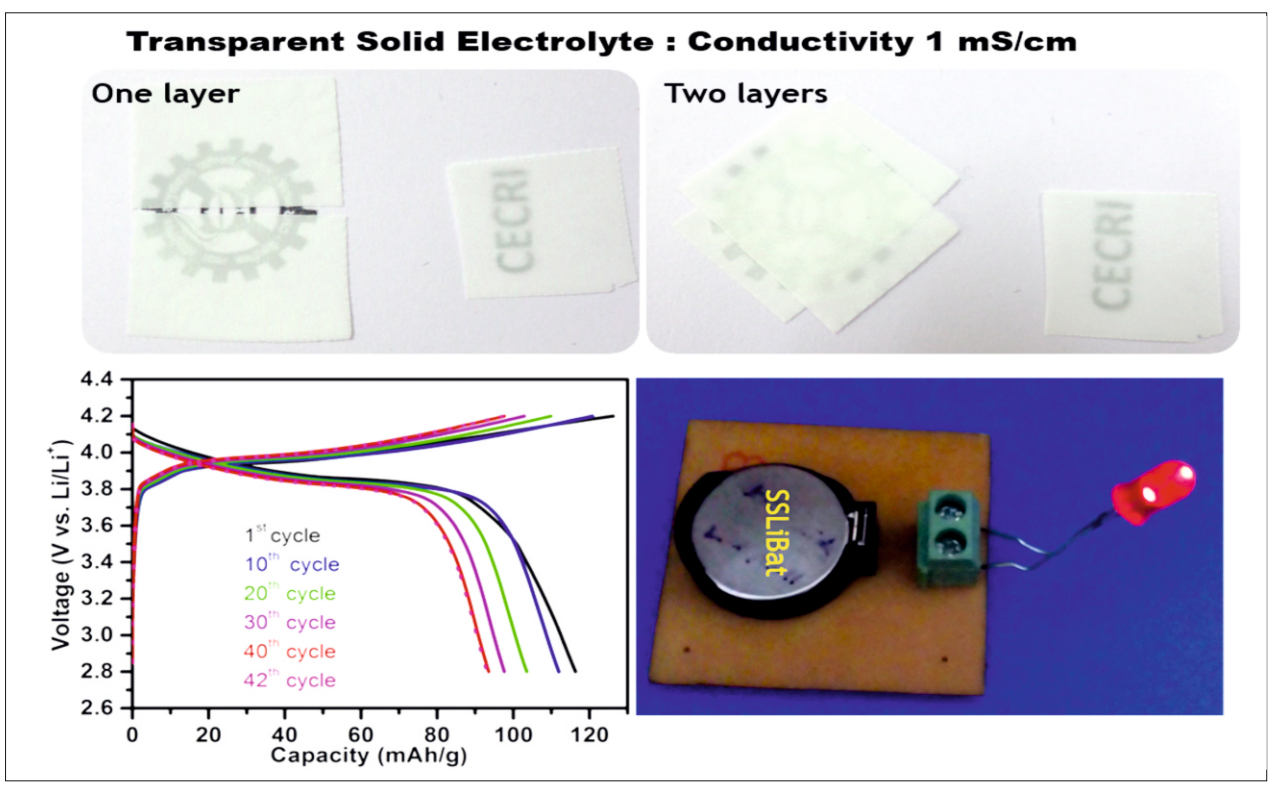


Figure. Photograph of transparent solid electrolyte membranes, charge-discharge profiles of fabricated all solid state battery and glowing of a red LED powered using the all solid state battery

GAP-15/15

Switching from silicon to organic materials: New vistas for future generation electronics

Division(s): Materials Electrochemistry

PI: Dr. C. Praveen

Mentor: Dr. M. Sathish

Funding agency: DST, New Delhi

Duration: 12.02.2015 to 12.02.2020

Budget (Rs. in Lakh): 35.00

Objectives

The main objective is to design and synthesize organic chromophores which could

- Replace conventional SiO_2 dielectric in micro and nanoelectronic devices
- To extend their role as passivation layers and O_2 barrier for germanium or III/V semiconducting materials in order to promote their use in large area electronics.
- In other words, the aim of this project is to prove (proof-of-concept) that organic high-k dielectrics are a viable answer for the passivation and the integration of the Ge and III/V materials for the next generation devices.

Highlights

- Synthesized a series (10 compounds) of thienyl spacing D–π-A push-pull chromophores end-capped with a triphenylamine (TPA) donor and tetracyanobutadiene (TCBD) acceptor in high yields
- Acetylenic precursors displayed strong emissive properties with a large Stokes shift and positive solvatochromism
- Low optical band gap (1.38 to 1.62 eV) coupled with excellent molar absorptivity (28800 to 90500 $M^{-1}cm^{-1}$) of targeted chromophores ensure good light-harvesting ability
- Derived HOMO (-5.31 to -5.16 eV) and LUMO (-3.49 to -4.31 eV) from electrochemical studies reveal these materials as promising ones for organic solar cell applications
- An inverse bulk heterojunction (BHJ) photovoltaic device with a cell configuration of ITO/ZnO/BHJ/V_2O_5/Ag was fabricated to demonstrate the potential applications of these molecular semiconductors as active layer materials
- A reasonable power conversion efficiency ranging from 1.95 to 3.33% has been demonstrated

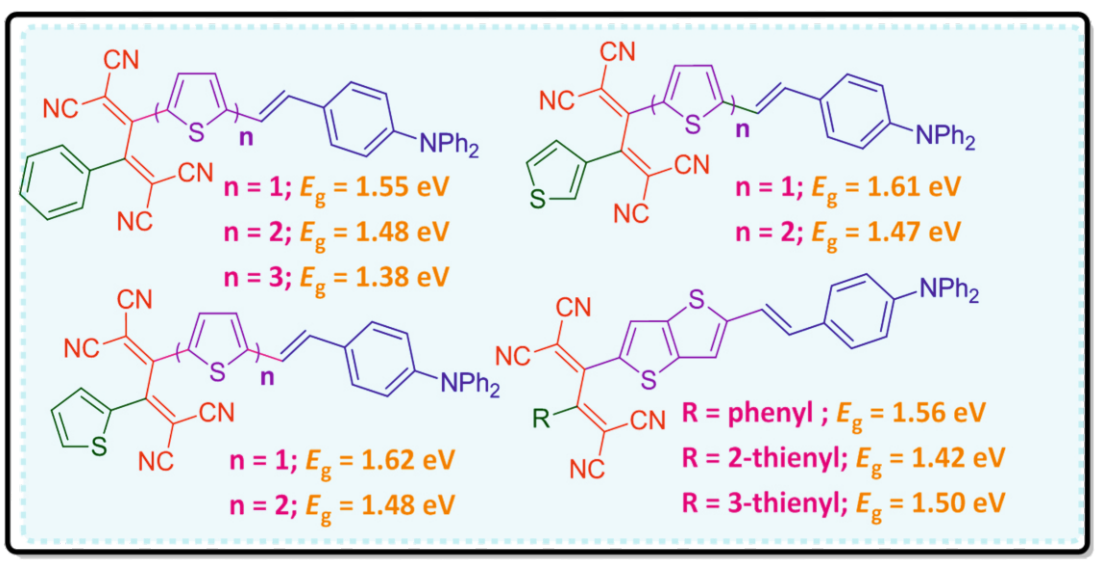


Figure. New π-conjugated organic semiconductors synthesized for solar cell applications

GAP-21/15

Hierarchical composite nanostructure photocatalysts for efficient water splitting under solar light irradiation

Division(s) involved: Materials Electrochemistry

PI: Dr. M. Sathish

Funding agency: MNRE, New Delhi

Duration: 01.03.2016 to 28.02.2019

Budget (Rs. in Lakh): 33.08

Objectives

- To develop efficient and stable photocatalysts (using core/shell concept) for overall water splitting under solar light irradiation.
- Synthesis, optimization, characterization and photocatalytic activity tests for H_2 production using Semiconductor core @ Semiconductor shell nanostructures.
- Detailed photocatalytic studies on stability, recyclability and relative quantum efficiency measurements to obtain the best catalyst system

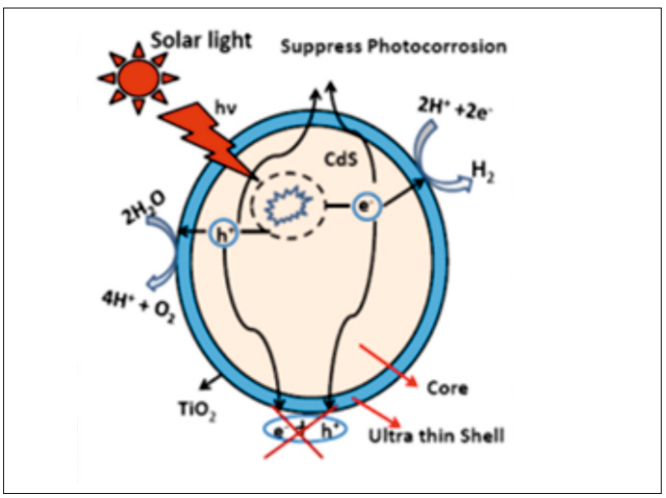


Figure. Core-shell structured photocatalyst

Highlights

- Non-noble metal-based photocatalyst - Cu-Cr_2O_3 core-shell structured co-catalyst on TiO_2 photocatalyst showed a high photocatalytic H_2 production activity of 82,390 µmolh-1g-1cat
- CuO-Cr_2O_3/TiO_2 catalyst showed no significant change in photocatalytic activity during recycleability test for three cycles for three days
- Effective shuttling of photo-excitons on Cds/NiO core/shell photocatalysts for enhanced photocatalytic hydrogen production
- Titania wrapped cadmium sulfide nanorods for photocatalytic hydrogen generation has been synthesized

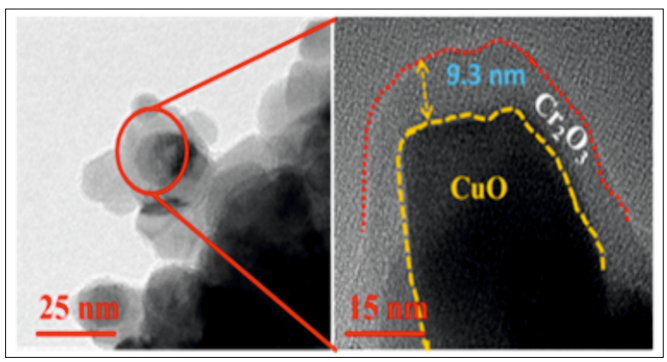


Figure. HR-TEM images of core-shell nanostructured Cu-Cr_2O_3 co-catalyst

GAP-22/15

Applications of homogeneous gold catalysis and C-H activation reactions for the synthesis of bioactive carbo- and heterocycles

Division(s) involved: Materials Electrochemistry

PI: Dr. C. Praveen

Mentor: Dr. M. Sathish

Funding agency: DST-SERB, New Delhi

Duration: 01.12.2015 to 30.11.2018

Budget (Rs. in Lakh): 19.44

Objectives

- To synthesize carbo- and heterocycle products mimicking natural products and clinical drugs by utilizing transition metal catalysis as the key step
- To execute the synthesis in an environmentally benign process using a recyclable catalyst
- To investigate the pharmaceutical activity of the prepared pharmacophores in different bioassays
- To assess the bio-activity and structure-activity relationship (QSAR, molecular docking, molecular dynamics, etc.)
- To explore the use of synthesized compounds in various pharmaceutical industries following phase-I, phase-II, and phase-III trials after understanding the bio-availability and toxicology.

Highlights

- A fast, mechnochemical and solvent-free synthesis of substituted tetrahydropyrimidines and octahydroquinazolines using Au(III) catalysis has been developed
- Tetrahydropyrimidines and octahydroquinazolines were successfully employed for anticonvulsant potency
- New hybrid pharmacophores by merging Baylis–Hillman and click chemistry under ball-milling conditions were synthesized in high yields and with excellent regioselectivity
- The substrate scope of the reaction was broadened to include alkyl, benzyl, and aryl groups. A catalytic amount of CuO nanoparticles (CuO NPs, < 50 nm) which was used to carry out the click reaction could be easily recovered by simple centrifugation, and CuO NPs were found to be catalytically active for almost six cycles
- Other highlights includes: (i) solvent-free reaction conditions, (ii) short reaction time, (iii) no rigorous solvent extraction, (iv) good to excellent chemical yields, (v) 100% atom economy, (vi) CuO NP recycelability, (vii) good enantioselectivity, and (viii) low reaction temperatures
- The developed protocol significantly broadens the scope of mechanochemistry as it involves two dissimilar reactions with equal aplomb in a sustainable fashion.
- Biological assays and *in silico* studies revealed that compound 4m was most active in terms of its zone of inhibition (22 mm), MIC (16 μg mL^{-1}), and binding energy of –11.37 kcal mol^{-1}

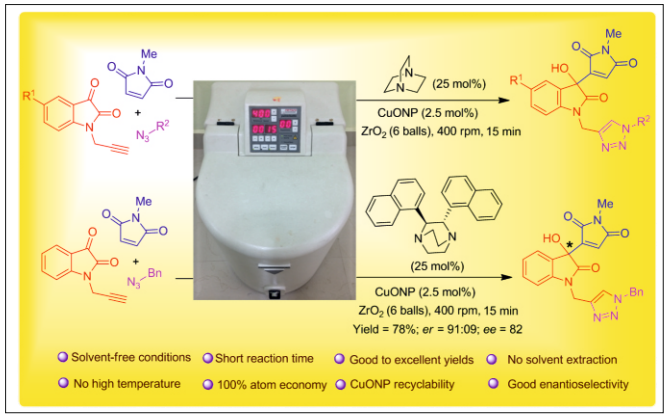


Figure. Synthesis of oxindole-triazole pharmacophores via mechanochemistry

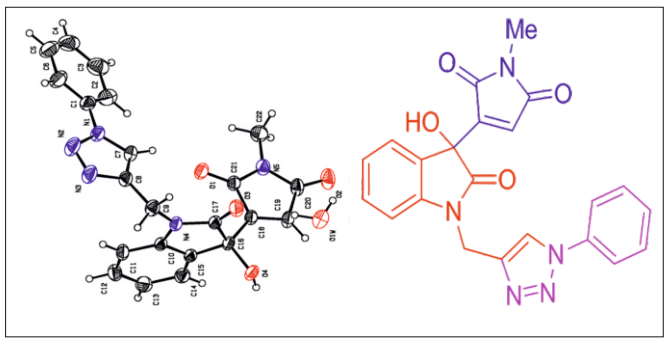


Figure. Single crystal XRD of compound 4e and its molecular structure

GAP-01/16

A supramolecular approach to improve the efficiency of enzyme mimic catalysis

Division(s) involved: Electro Organic

PI: Dr. K. Selvakumar (Inspire Faculty)

Mentor: Dr. D. Velayutham

Funding agency: DST, New Delhi

Duration: 07.12.2015 to 06.12.2020

Budget (Rs. in Lakh): 35.00

Objectives

- To design and synthesize biomimetic catalytic system that combines the molecular recognition element and catalytic active site near a hydrophobic scaffold. Such catalytic systems are expected to catalyze the chemical reaction in mild aqueous conditions with enhanced substrate selectivity and the catalytic efficiency
- To construct supramolecular catalytic sensor array

Highlights

- Metallophthalocyanine and metallophthalocyanine embedded graphene oxide/reduced graphene oxide (GO/rGO) materials, named CuPc (1), MnPc (2), GO-CuPc-PDA (3), GO-MnPc-PDA (4), rGOCuPc-PDA (5), rGO-MnPc-PDA (6), (where CuPc = Copper phthalocyanine, MnPc = Manganese phthalocyanine, PDA = polydopamine) were synthesized and dip coated over the glassy carbon electrode (GCE) surface to yield an array of six electrodes (1'-6')
- Distinct voltammetric oxidation signals towards the different biothiols, such as Cysteine (Cys), Glutathione (GSH), and Homocysteine (Hcys) by each of these electrodes
- The collective response of the electrode array was analyzed using chemometric analysis, such as linear discriminant analysis (LDA), which enables the simultaneous detection of Cys, GSH, and Hcys in the phosphate buffer
- The application of electrode array technique to the biomarker detection is often complicated due to the non-specific interferences of protein components present in biofluids
- A proof-of-principle demonstration made in which the above interference in discriminatory sensing of thiols can be circumvented via combining cross-reactivity of the electrode array with selective thiol reporting process of redox indicators (RIs), such as ascorbic acid (AA), dopamine (DA), and uric acid (UA)
- The discriminatory ability of the electrode array towards different biothiols and their concentration spiked in goat plasma sample is shown below as LDA score plot

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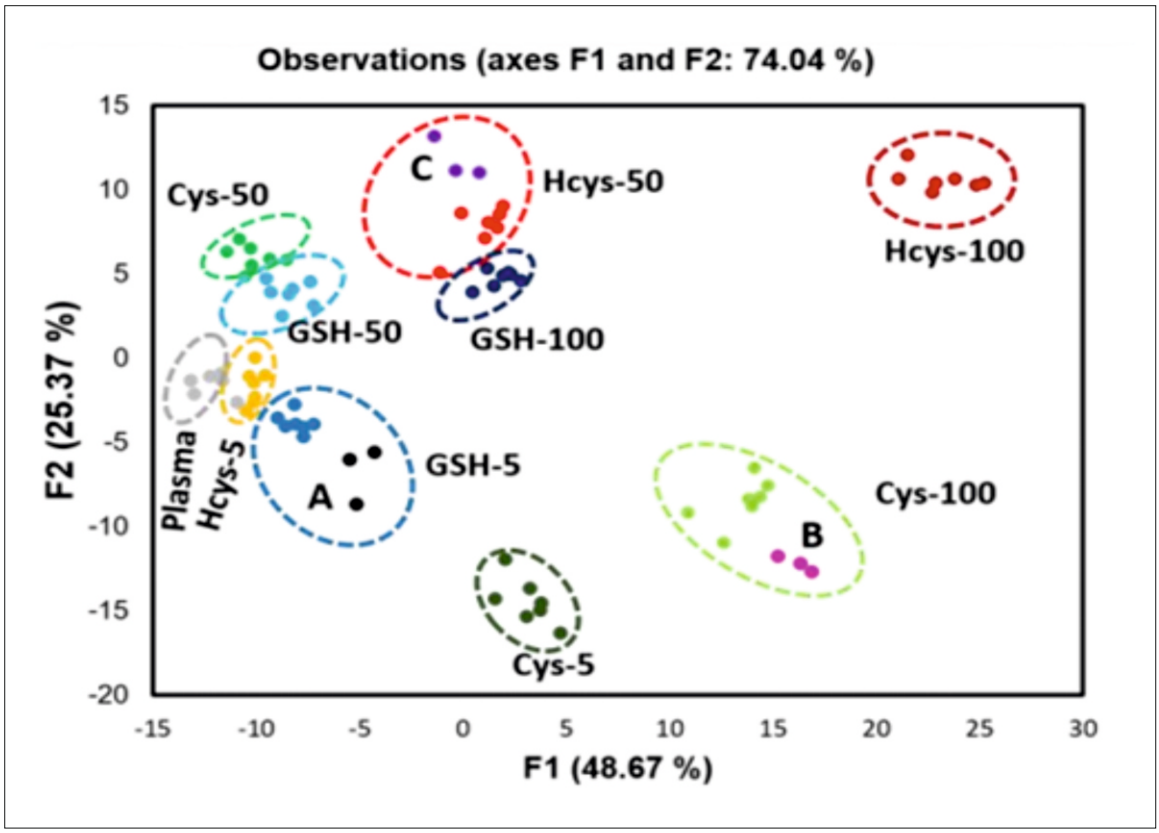


Figure. LDA score plot showing the discriminatory sensing of biothiols and their concentrations (in μM) spiked in goat plasma samples



Lecture by Dr. Andrea Sorrentino, Italy & Dr. Giovanni Landi, Italy

GAP-06/16

Investigation of the performance of two-dimensional nanomaterials towards biomedical application

Division(s) involved: Electrodics and Electrocatalysis

PI: Dr. Mukesh Mishra (NPDF)

Mentor: Dr. Subbiah Alwarappan

Funding agency: DST-SERB, New Delhi

Duration: 04.07.2016 to 03.07.2018

Budget (Rs. in Lakh): 19.20

Objectives

The two-dimenstional nanosheets of graphene, MoS_2 and WS_2 are the target materials of interest in this work. The objectives are:

- To optimize the quality and quantity of two-dimensional nanosheets and quantum dots of target materials
- Optimization of power and time period of microwave treatment to form quantum dots of target materials
- To study the behavior of graphene, MoS_2 and WS_2 nanosheets and their quantum dots towards biomedical application such as drug delivery, cancer therapy, and biological imaging
- To investigate the possible modification to optimize the biomedical applications of graphene, MoS_2 and WS_2 nanosheets
- To determine the degree of sensitivity of two-dimensional nanosheets and quantum dots of graphene, MoS_2 and WS_2 sheets towards the detection of disease-affected cells
- To find out the role of ligand in the biomedical application of two-dimensional nanosheets and quantum dots of graphene, $MoS_2$and WS_2sheets

Highlights

- High quality and high throughput synthesis of two-dimensional nanosheets and quantum dots and metal nanoparticles for imaging and advanced sensing purposes
- The effects of soaking and sonication on the sensing behavior of two-dimensional nanosheets are near completion
- Evaluated the loading power of bulk and nanosheets
- The sensing behavior of quantum dots towards metal ions and biomolecules are under progress
- Chemical synthesis of hybrid nanosheets for sensing application is under progress



MoU between CECRI and Hindustan Zinc Limited (HZL), Udaipur

GAP-08/16

Organic and inorganic halide perovskite for high-performance solar cell

Division(s) involved: Materials Electrochemistry

PI: Dr. Ramesh Mohan (DST-Inspire Faculty)

Mentor: Dr. M. Sathish

Funding agency: DST, New Delhi

Duration: 19.09.2016 to 18.09.2021

Budget (Rs. in Lakh): 35.00

Objectives

- The environmentally stable organic solar cell and organometallic halide perovskite solar cell will be fabricated by replacing the molecular species and device with larger and denser crystalline domains
- The ITO-free large area device from 1, 3, 5, and 10 cm^2 areas will be fabricated with maintaining the efficiency above 7 %
- Apart from the spin coating method, large area device fabrication will be made with other coating methods such as blade coating, spraying, printing, slot-die coating
- Further, the toxic Pb will be gradually replaced with an environmentally friendly divalent group element to maintain the reasonable performances

Highlights

- The effect of air processed polymer solar cells fabricated from conjugated polymers and fullerene derivatives poly (3-hex-ylthiophene) and [6, 6]-phenyl-C61-butyric acid methyl ester functioning as donor and acceptor materials
- The device architecture was Cs_2CO_3/P3HT: PCBM/V_2O_5/Al
- The spin rate of the Cs_2CO_3 and P3HT: PCBM layer was subjected to vary and its device performance was evaluated
- The photo-conversion efficiency was enhanced from 0.1 to 1.43% with the J_{sc} of 5.6 mA cm^{-2}; V_{oc} of 0.55 V and FF of 0.454 by varying the spin conditions

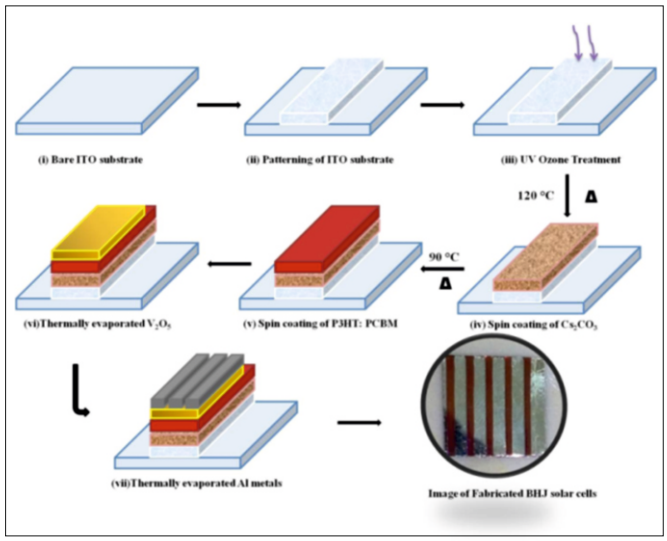


Figure. Schematic representation of inverted BHJ device fabrication

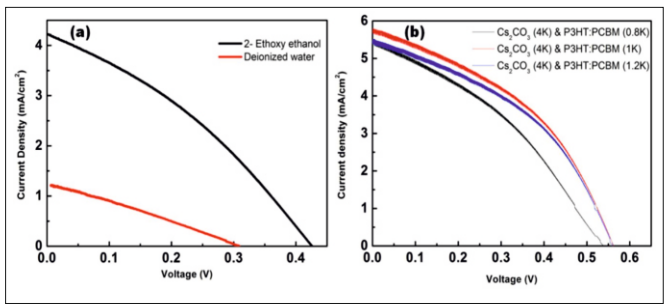


Figure. J-V characteristics curve of (a) Cs_2CO_3 at different solvents and (b) optimized cells

GAP-09/16

Investigation of high-performance electrodes and electrolytes for advanced zinc-bromine redox flow batteries

Division(s) involved: Electrochemical Power Sources

PI: Dr. P. Ragupathy

Co-PI: Dr. P. Periasamy

Funding agency: DST-SERB, New Delhi

Duration: 19.09.2016 to 18.09.2019

Budget (Rs. in Lakh): 42.42

Objectives

- To investigate the electrocatalytic effect of graphene, graphene oxide, functionalized graphene (-OH, -COOH), doped graphene (N, B F) and graphene/MO composites (M = Mn and Co) on bromine/bromide redox couple for zinc bromine redox flow battery
- To study the effect of electrolyte concentration on the stability of the electrochemical interface and to estimate of polarization behavior of the proposed electrocatalytic electrodes for both zinc and bromine electrodes in unit cells (5 X 5 cm^2)
- To understand the influence of zinc dendrite by various morphological changes on zinc electrode during zinc deposition and dissolution
- To evaluate the cell performance of ZBB with graphene-based electrocatalysts and novel class of electrolyte to demonstrate prototype zinc bromine redox flow battery
- To understand the influence of zinc dendrite by various changes on zinc electrode during zinc deposition and dissolution
- To evaluate the cell performance of ZBB with graphene-based electrocatalysts and novel class of electrolyte to demonstrate prototype zinc bromine redox flow battery

Highlights

- Demonstrated a single step synthesis of halogen functionalized graphenes (HGs) through electrochemical exfoliation of graphite in aqueous potassium halide solutions
- The degree of halogenation was found to vary between 2.32 and 0.26 atomic % in fluorinated graphene (FG) and iodinated graphene (IG), respectively, which could be attributed to the difference in reactivity of the halogen species generated during the exfoliation process
- Among all HGs, FG has shown the superior electrocatalytic behavior for $2Br^-/Br^2$ redox reaction. The anodic (11.2 mA cm^{-2}) and cathodic (10.7 mA cm^{-2}) peak current densities are higher for FG than that of other halogenated graphenes
- Enhanced electrochemical performance in terms of efficiency (81% of voltaic efficiency and 72% energy efficiency) and durability up to 350 cycles for ZBB flow cell fabricated with FG as bromine electrode

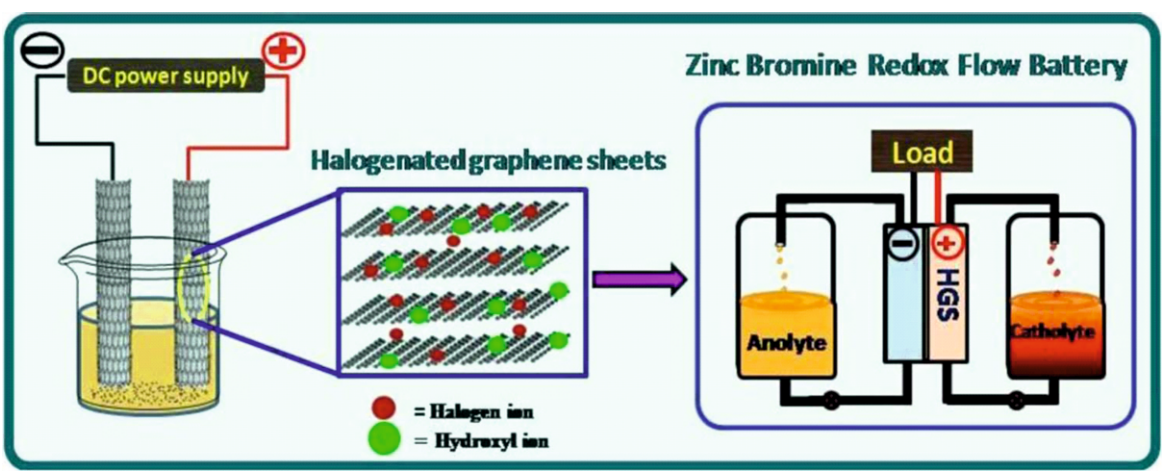


Figure. Schematic representation of the synthesis of halogenated graphene and zinc bromine redox flow battery

GAP-11/16

Nanostructured materials for electrocarboxylation process in protic ionic liquid medium

Division(s) involved: Electro Organic

PI: Dr. V. Suryanarayanan

Co-PI: Dr. D. Velayutham

Funding agency: DST, New Delhi

Duration: 12.09.2016 to 11.09.2019

Budget (Rs. in Lakh): 23.00

Objectives

- Electrochemical deposition of nanostructured alloy materials in ionic liquid medium and their characterization
- Application of the materials for electrocarboxylation process

Highlights

- Electrochemical synthesis of silver (Ag) and silver–copper (Ag–Cu) bimetallic composite electrodes on a GC substrate in triethylammonium acetate (TEAA) by electrodeposition to investigate their suitability as cathodes for the electrocarboxylation process
- Higher reductive current on the electroreduction of benzophoenone in the presence and absence of carbon dioxide for the Ag–Cu composite containing 23% of Cu (Ag77–Cu23) than that of other Ag-based composite electrodes
- The reaction mechanism involves the chemical reaction between the electrogenerated anion radical $(Ph)_2CO^-$ and CO_2 followed by a rapid one electron reduction process to form benzilic acid
- The efficient generation of anion radical from the electroreduction of benzophenone by Cu–Ag dendritic structures during the carboxylation of benzophenone in this medium, is a key step for the improvement on the yield of the product

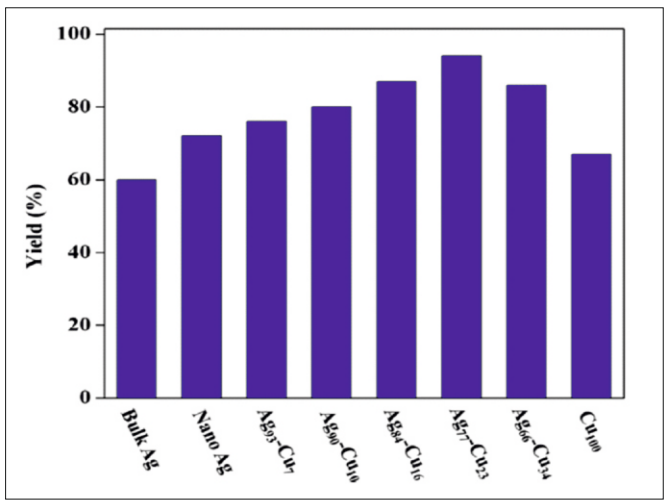


Figure. Potentiostatic electrocarboxylation of benzophenone (0.1 M) on different electrode materials in 0.1 M $TBABF_4$ /DMF medium. Applied potential is 1.90 V vs Ag/AgCl

GAP-14/16

Biocarbon anodes for energy storage device applications

Division(s) involved: Electrochemical Power Sources

PI: Dr. N. Kalaiselvi

Funding agency: DST-SERB, New Delhi

Duration: 16.11.2016 to 15.11.2019

Budget (Rs. in Lakh): 19.83

Objectives

- Preparation and activation of carbon derived from domestic and industrial biomass waste through filth-to-wealth conversion
- Development of heteroatom(s) doped biocarbons by choosing appropriate waste/adoption of suitable treatment
- Qualifying select biocarbons as anodes for lithium-ion and sodium-ion batteries; bioscaffold for sulfur infusion in Li-S systems
- Preparation of composites with other carbon/metal oxide/electrode for multifarious device applications including supercapacitors
- Evaluation and comparison of the electrochemical performance of series of biocarbons in batteries and supercapacitors
- Recommendation of potential anode/electrode candidates for lithium-ion, lithium-sulfur and sodium-ion batteries, and supercapacitors
- Can we suggest one biocarbon suitable for multifarious device application with superior electrochemical properties?

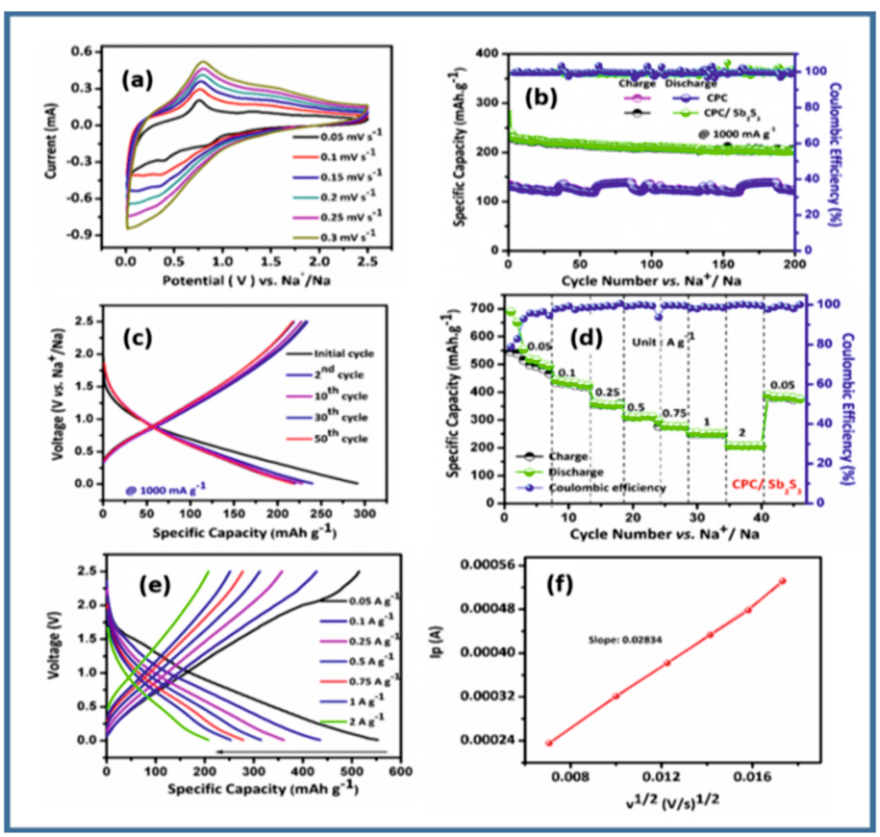


Figure. Electrochemical studies of CPC/Sb_2S_3 anode in SIBs (a) CV curves obtained in the range of 0.01 to 2.5 V potential window at various scan rates (b, c) Charge-Discharge studies of pristine and CPC/Sb_2S_3 at a current density of 1000 mA g^{-1} (d, e) rate capability of CPC/Sb_2S_3 (f) relationship between peak currents and sweep rates of CPC/Sb_2S_3

Highlights

- Waste derived bio-carbon electrode material: Corn silk (domestic waste) and coir pith (industrial waste) driven electrode materials were prepared and activated with KOH, prior to the investigation or composite formation and subsequent application in storage devices
- Corn-silk derived carbon (CSC) synthesized by simple KOH activation exhibited the electric double layer capacitive (EDLC) behavior with long term electrochemical stability
- The reaction mechanism associated with the surface of CSC electrode does not obey the diffusion controlled process
- Galvanostatic cycling behavior of CSC electrode exhibits an initial capacity value of 60 mA h g^{-1} and the capacity retention value at the 1000th cycle (when compared with the initial cycle) is more than 70 % substantiating the excellent stability of the chosen CSC electrode material
- A maximum specific capacity of 256 mA h g^{-1} at a tested current density of 0.1 A g^{-1} for CSC electrode
- Full cell performance of the CSC electrodes in a device using various cell architectures such as coin and flexible symmetric pouch cell revealed CSC as a good electrode material for capacitor applications also apart from its application in batteries
- Coir pith derived carbon (CPC) added with Sb_2S_3 has been investigated for its use as a potential anode in lithium- and sodium-ion batteries (LIBs and SIBs)
- In LIBs, CPC/Sb_2S_3 composite anode delivers a discharge capacity of 1100 mAh g^{-1} for 200 cycles at a current density of 100 mA g^{-1} and withstands a higher capacity than pristine anodes in LIBs
- In SIBs, CPC/Sb_2S_3 composite anode delivers a discharge capacity of 220 mAh g^{-1} at a current density of 1000 mA g^{-1} for 200 cycles
- The synergistic effect of CPC and Sb_2S_3 leads to the highest capacity values at various current rates in both LIBs and SIBs.



Dry room facility for Li-ion battery fabrication

GAP-23/16

Morphology tuned nanomaterials through electrochemical method for hemoglobin, creatinine, sweat, lactate and urea bio-sensing applications

Division(s) involved: Electrodics and Electrocatalysis

PI: Dr. S. Sasikala (NPDF)

Mentor: Dr. V. Ganesh

Funding agency: DST-SERB, New Delhi

Duration: 01.02.2017 – 01.02.2019

Budget (Rs. in Lakh): 19.20

Objectives

- Preparation of various size- and shape-controlled nanostructures of metals like gold, copper and nickel using electrochemical methods
- Structural and morphological characterization of the resultant materials using spectroscopic, microscopic and electrochemical techniques
- Exploring the possibility of employing such nanostructured materials for human sweat analysis
- Design and fabrication of electrochemical biosensors for lactate, urea, hemoglobin, creatinine, and sweat
- Development of electrochemical methodologies for sensing of lactate, urea, hemoglobin, creatinine, and sweat using unconventional electrolytes and explore them for (bio)sensing applications.

Highlights

- A template-free, low cost, simple and novel bio-assisted synthesis of efficiently architectured nanostructures - Fe_2O_3 and their electrochemical applications for detection of bio-analytes
- Various nanostructures of -Fe_2O_3 namely, nanospheres, nanograsses and nanowires prepared using a bio-surfactant namely Fenugreek seeds (FS) extract through co-precipitation method by following "green" route
- Good electrochemical activity of the prepared -Fe_2O_3 nanostructures towards sensing of bio-analytes such as uric acid and dopamine in a reproducible, stabe, and selective manner
- These materials can be used for healthcare diagnostic applications especially for kidney diseases and human sweat related diseases

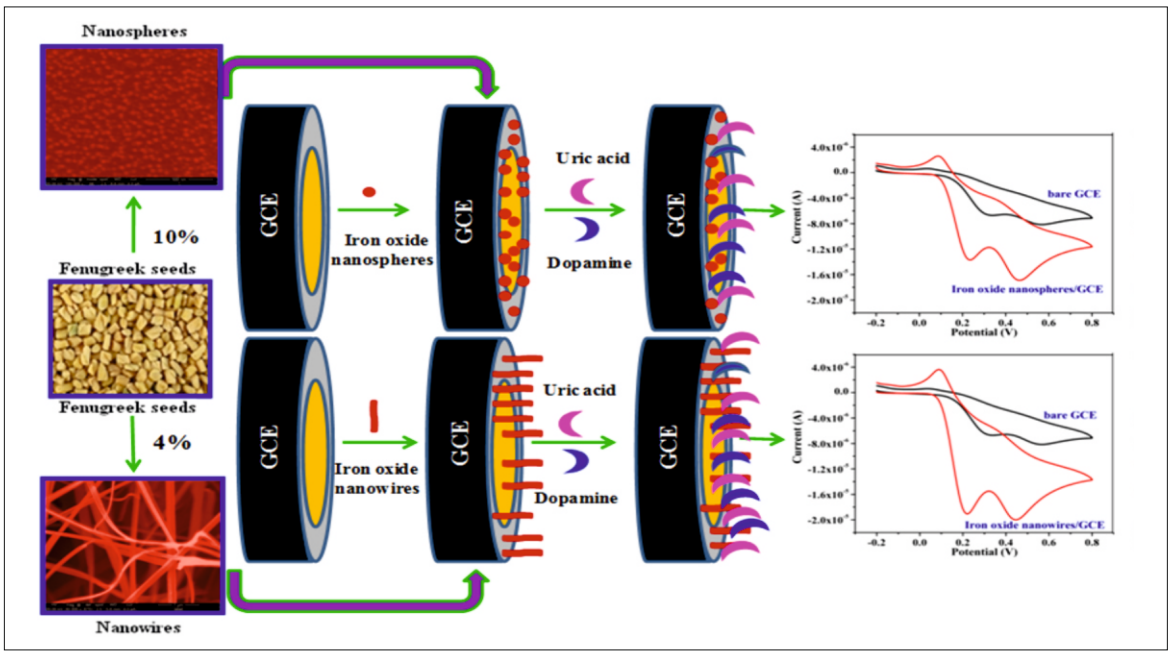


Figure. Schematic representation of iron oxide nanostructures prepared from a bio-surfactant and their utilization for electrochemical sensing of uric acid and dopamine

GAP-01/17

Erosion and erosion-corrosion performance of electrodeposited copper and its alloys

Division(s) involved: Corrosion and Materials Protection

PI: Dr. Rakesh C Barik

Co-PI: Dr. S. Mohan

Funding agency: DST, New Delhi

Duration: 24.03.2017 to 23.03.2020

Budget (Rs. in Lakh): 31.12

Objectives

- Corrosion performance of copper and electrodeposited copper and copper-nickel alloys
- Corrosion performance of coated copper in particular to the influence of various electrochemical deposition parameters (direct current and pulse current)
- Synergistic effects of erosion and corrosion in sand slurries in a jet impingement and rotating cage rig
- Mass transfer kinetics of cathodic reactants such as dissolved oxygen (mass transfer kinetics as a function of flow rates)
- Application of electrochemical measurement techniques to erosion-corrosion to characterise the synergistic effects
- Influence of surface hardness, pulse duty cycle on the thickness of copper deposits on synergy during erosion-corrosion

Highlights

- Successfully electrodeposited less porous and fine grains of copper on mild steel at lower peak current density and higher duty cycle
- Studied the corrosion performance of direct and pulse copper electrodeposited substrates
- Flow corrosion properties studied by rotating cage rig – corrosion rate decreased with increased flow velocity
- Studied the influence of duty cycle on the thickness of copper deposits, bath temperature, and pH – thickness increased with increasing frequency of deposition

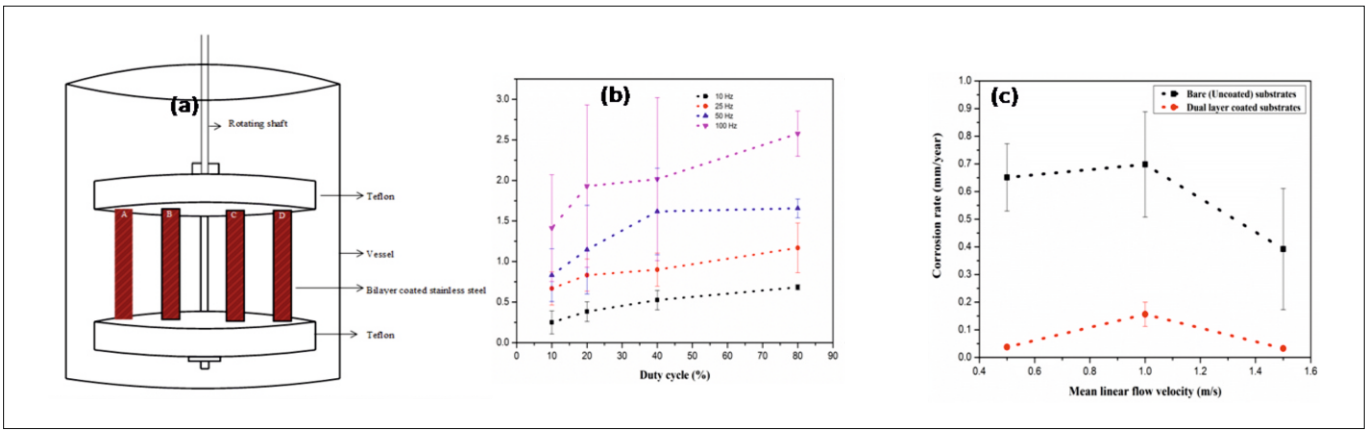


Figure. (a) Flow rig, (b) coating thickness and (c) corrosion rate

GAP-02/17

Chemical synthesis and characterization of novel polymelamine and metal coordinated polymelamine for energy storage and generation applications

Division(s) involved: Electrochemical Power Sources

PI: Dr. K. Senthilkumar (NPDF)

Mentor: Dr. S. Gopukumar

Funding agency: DST, New Delhi

Duration: 01.03.2017 to 28.02.2019

Budget (Rs. in Lakh): 19.20

Objectives

- Chemical synthesis of polymelamine using melamine and sodium hypochlorite. The synthesized polymelamine will be applied to supercapacitor and lithium ion batteries
- Synthesis of nickel co-ordinated polymelamine for supercapacitor application
- Synthesis of cobalt co-ordinated polymelamine for supercapacitor application
- Synthesis of seed mediated platinum nanoparticle growth over polymelamine for methanol fuel cell applications

Highlights

- Identification of high rate capable hard carbon derived from *Prosopis juliflora* (seemai karuvelam) tree as anode material for sodium ion batteries
- Recently, Madurai High Court issued an order to completely remove *Prosopis juliflora* (seemai karuvelam) trees throughout Tamil Nadu state as they occupy 25% of farming land and consume more ground water for their growth. It is highly important to use the removed trees as valuable products. We have used *Prosopis juliflora* tree to synthesize hard carbon and demonstrated its applications in sodium ion batteries
- Identification of two types of hard carbons, namely, type A and type B
- The application of type A hard carbon as anode material for sodium ion batteries
- The difference was found to correlates with electrical conductivity (2.6 S/cm *vs.* 2.0 S/cm), tap density (0.58 g/cm^3 *vs.* 0.68 g/cm^3) and carbonaceous defects (0.99 *vs.* 1.15) of type A and type B hard carbon, respectively.

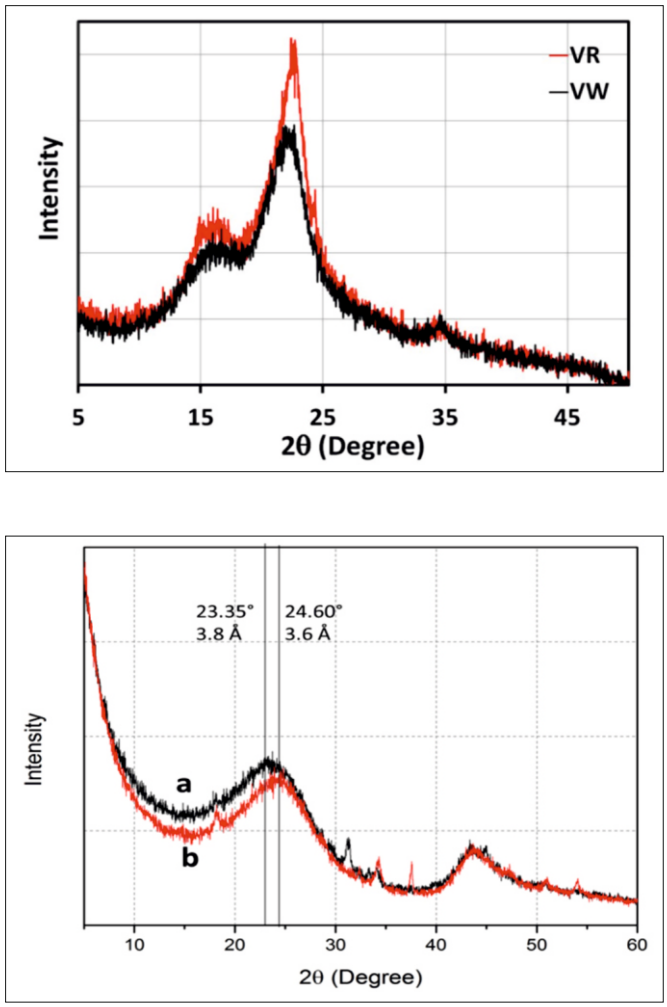


Figure. XRD patterns of sapwood (black) and heartwood (red) of Prosopis Juliflora tree. The right side patterns correspond to the hard carbons derived from sapwood (black) and heartwood (red), respectively. Note: The crystallinities of sapwood and heartwood are 35% and 43%, respectively

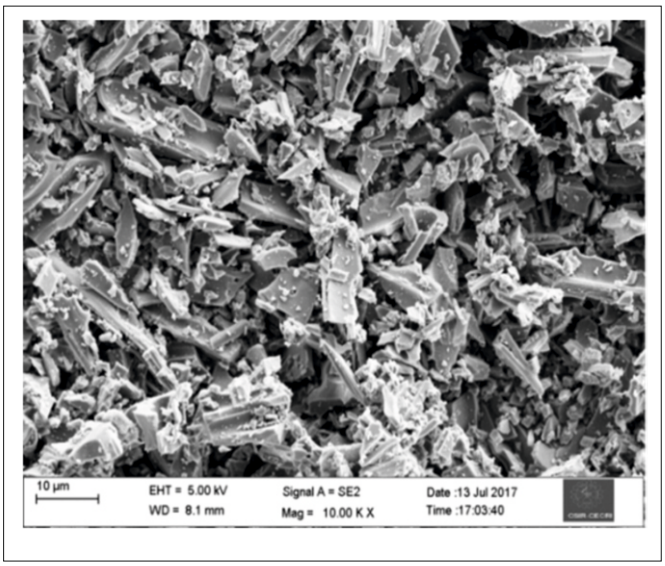


Figure. FE-SEM images of hard carbons prepared using sapwood at1600 °C

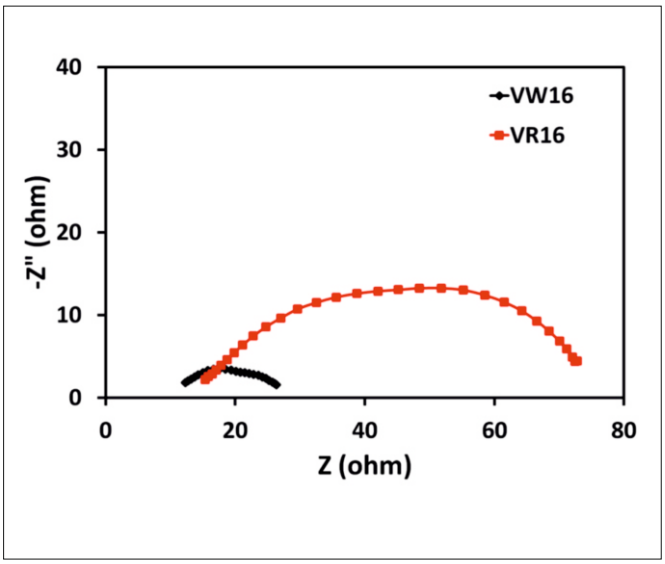


Figure. Electrochemical impedance spectra of Type A (black) and Type B (red) hard carbons at 50 mV (Ep= (Epa+Epc)/2)

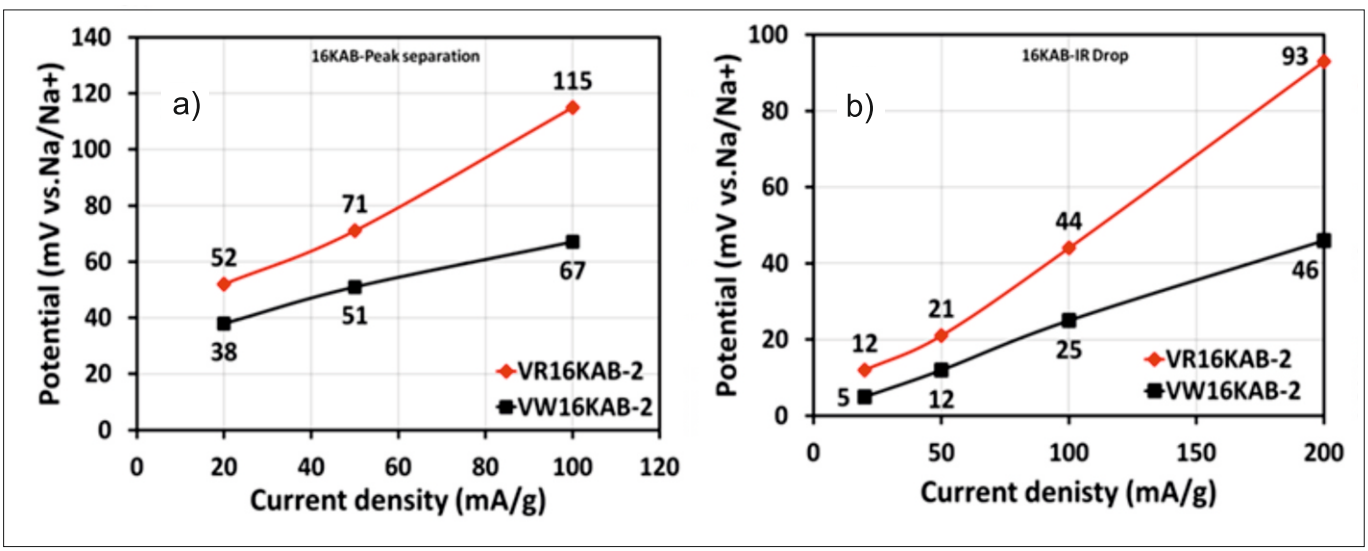


Figure. a) Peak separation vs. current density of Type A and Type B hard carbons.
b) IR drop vs. current density of Type A and Type B hard carbons

GAP-03/17

Nanoionics: Molecular design principle and charge transport in confined systems for the development of next-generation electrochemical device applications

Division(s) involved: Materials Electrochemistry

PI: Dr. Karthik Krishnan (DST-Inspire Faculty)

Co-PI: Dr. B. Subramanian

Funding agency: DST, New Delhi

Duration: 14.12.2016 to 13.12.2021

Budget (Rs. in Lakh): 86.27

Objectives

- Development of nanoionics for various electrochemical devices

Highlights

- Manipulation of ionic transport in the self-assembled polymer thin films for the development of novel electronic devices with the ultrafast operation and low-power consumption
- Developed an ultrafast humidity responsive flexible planar device for human respiration monitoring
- Humidity sensing behavior of the polymer-based planar devices – a polyethylene oxide–phosphotungstic acid (PEO–PWA) thin film placed between an opposing inert electrodes
- Optimized the device configuration and PWA salt concentration in the PEO matrix
- The ultrafast response (~50 ms) and recovery (~52 ms) of the humidity sensor enabled to study the real-time human respiration monitoring
- The ultrafast response-recovery time for this sensor is ascribed to their self-assembled lamellar-like structures of the PEO–PWA matrix polymer that provides long-range continuous proton transport path in the polymer interface
- Possible development of polymer-based flexible humidity sensor for practical applications such as wearable health and environmental monitoring devices

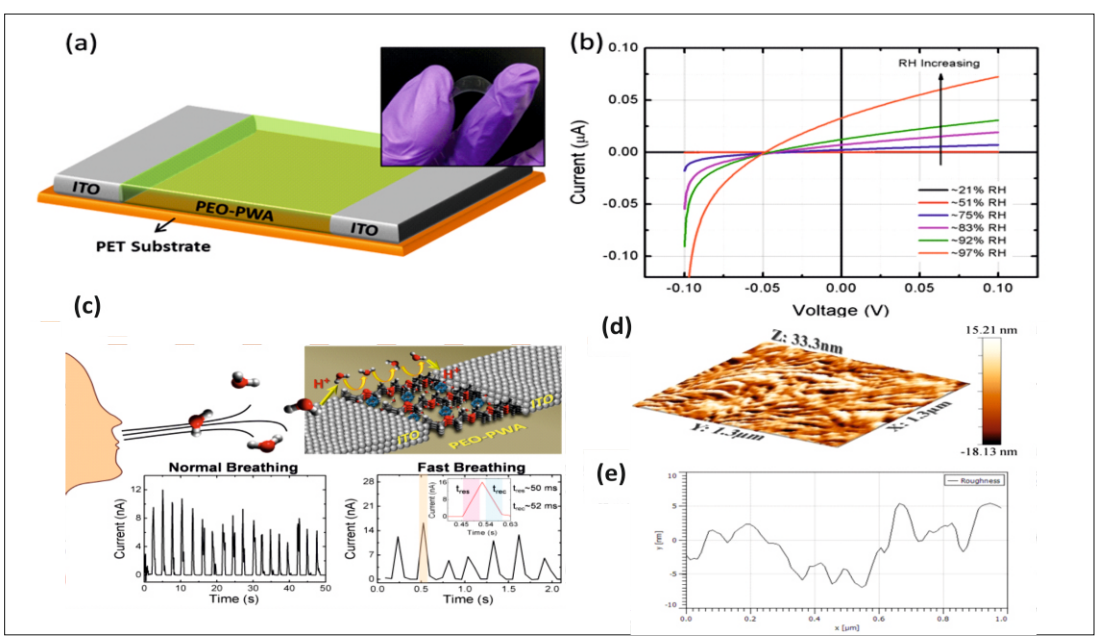


Figure. (a) Schematic of the fabricated flexible planar ITO/PEO-PWA/ITO device (inset shows the photograph of the sensor on a PET substrate), (b) RH dependent I–V plots of the device under flat condition, (c) schematics of the proposed proton transport mechanism in a planar device under normal and fast breathing. (d) 3D-AFM image of PEO–PWA thin film, representing the lamellar-like polymer structure, and (e) the corresponding surface roughness profile reveals the occurrence of uniform film morphology with a roughness of ≈ 13 nm

GAP-05/17

Scanning tunneling microscopy studies of porphyrins and phthalocyanines

Division(s) involved: Corrosion and Materials Protection

PI: Dr. Saranyan Vijayaraghavan

Funding agency: DST, New Delhi

Duration: 01.04.2017 to 31.03.2020

Budget (Rs. in Lakh): 41.00

Objectives

- To study the electronic effects on metal single crystals
- To study porphyrin and phthalocyanine single molecules with metal centers and tailoring nanostructures
- Studying charge transfer complexes

Highlights

- Characterization of Si (111) single crystals in UHV
- STM studies of crystalline behavior of Si
- Voltage dependant studies of phthalocyanine molecules

Si (111) crystals were used as a platform for studying charge transfer complexes using phthalocyanine and related molecules. A successful estimation of the charge transfer complex is planned to be studied and characterized with XPS, STM and TERS. Herein, both scanning tunneling microscopy studies and atomic force microscopy studies were carried out for analyzing the crystalline behavior of Si and the molecules. The charge transfer idea was extended to study dichalcogenides with phthalocyanines as this kind of interaction is highly useful in energy related applications and tribology. WS_2 nanosheets were prepared by exfoliation technique. Typically, 3 ml of DMF was added to 0.3 gm of bulk WS_2 powder and was ball milled for 3 hr. at 300 rpm. The resulting suspension was then probe sonicated for 4 hr. Copper phthalocyanine (CuPc) solution was prepared by dissolving 0.1 mg of CuPc into 10 ml of DMF. CuPc functionalized WS_2 nanosheets were prepared by stirring equal volumes of WS_2 nanosheets and CuPc suspension overnight. The functionalized nanosheets were characterized using Raman, UV, PL and HR-TEM studies. The work is still confined only to CuPc and chalcogenides. Porphyrin related work will commence based on the results we obtain here.

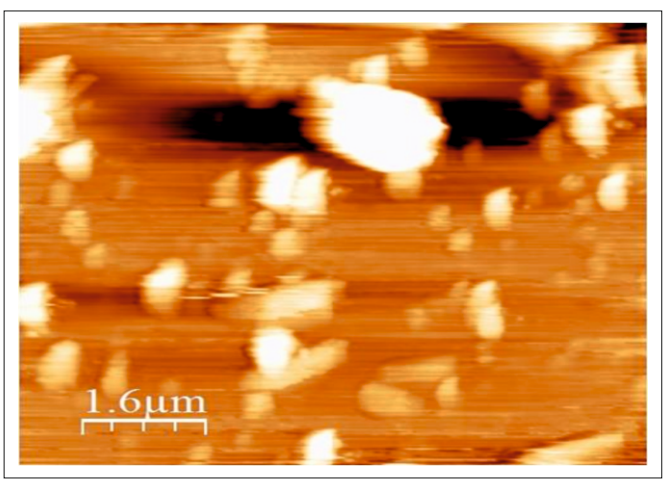


Figure. AFM image of WS_2 nanosheets

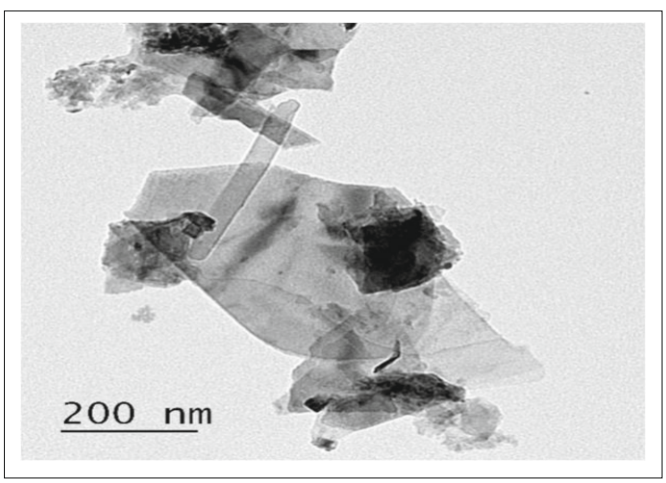


Figure. HR-TEM image of functionalized nanosheets

GAP-06/17

Electrodeposition of silver, gold, brass and some of the refractory metal from ionic liquids and assessment of these deposits in the electrocatalysis and industrial applications

Division(s) involved: Electroplating and Metal Finishing

PI: Dr. Shailendra Kumar Jha

Co-PI: Dr. S. Mohan

Funding agency: DST-SERB, New Delhi

Duration: 05.04.2017 to 04.04.2020

Budget (Rs. in Lakh): 23.07

Objectives

- Identification of air and water stable ionic liquids for electrodeposition of proposed metals and alloys
- Application of electrodeposited metals and alloys in electrocatalysis
- Understanding of growth kinetics of electrodepositing via theoretical and experimental approach

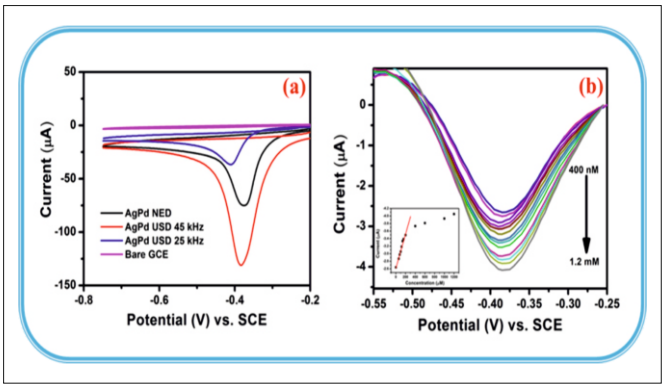


Figure. Electroreduction of hydrogen peroxide (H_2O_2)

Highlights

- Developed a facile one-step normal and variable frequency ultrasonic-wave assisted electrodeposition route to prepare AgPd alloy nanostructure catalyst films on glassy carbon plate from an ionic liquid medium
- The as-synthesized AgPd nanoparticles have been explored as bi-functional electrocatalyst, e.g., electro-reduction of H_2O_2 and methanol electrooxidation
- Ultrasonic wave electrodeposited AgPd (specifically 45 kHz) shows low detection limit (26.72 nM) for H_2O_2 sensor and excellent electrocatalytic activity towards methanol electrooxidation

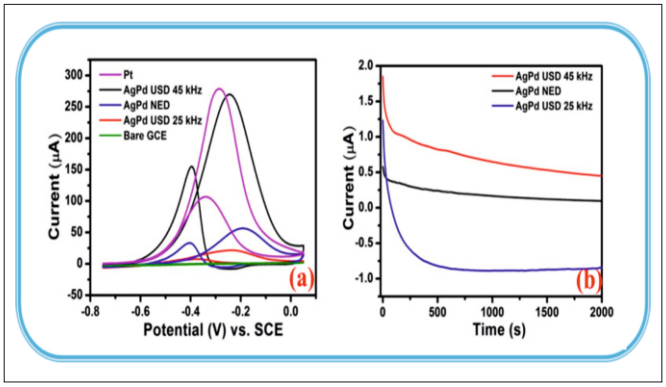


Figure. Electrooxidation of methanol (CH_3OH)

GAP-11/17

Redox flow batteries for renewable energy storage applications

Division(s) involved: Electrochemical Power Sources

PI: Dr. M. Ulaganathan (Ramanujan Fellow)

Mentor: Dr. P. Ragupathy

Funding agency: DST-SERB, New Delhi

Duration : 05.06.2017 to 04.06.2022

Budget (Rs. in Lakh): 89.00

Objectives

- To investigate and develop a novel electrolyte for the new vanadium redox flow cell
- Optimization of the electrolyte solutions leading to energy density of around more than 25 Wh/l and operating temperature range of 0 to 50 °C by increasing the solubility of the vanadium in the supporting electrolyte
- Development and optimization of ion exchange membranes for the novel vanadium redox flow cell
- To develop the electrode materials with good catalytic activities for enhance the reaction kinetics
- To develop and test the vanadium redox flow single/stack cell for demonstration.

Highlights

- Optimized vanadium based electrolyte with high concentration
- Chemically modified effective electrode materials towards better catalytic activity
- Developed a new Zn-V metal hybrid redox flow battery using Zn^{2+}/Zn^{0} and V^{5+}/V^{4+} redox couples exhibiting high voltage which is merely close to that of Zn-Br_2 flow battery
- Higher energy density of Zn-V flow battery than that of conventionally used Zn-Br_2 and all vanadium flow batteries
- Highly stable vanadium-based electrolyte of Zn-V flow battery is advantageous over the bromine counterpart used in the case of Zn-Br_2 flow battery
- The over potential drop in Zn-V flow battery is two times lower than that of the Zn-Br_2 system
- The new Zn-V system delivered a high power density of 840 $mW.cm^{-2}$ and the cell fabricated using microporous separator exhibits a high energy efficiency of 80% whereas it is observed about 71% for the Nafion-117 based system.
- High voltage, high energy density, eco-friendliness, low electrode polarization, less corrosiveness and high efficiency of the present Zn-V system enable to the development of viable futuristic off-grid energy storage technology

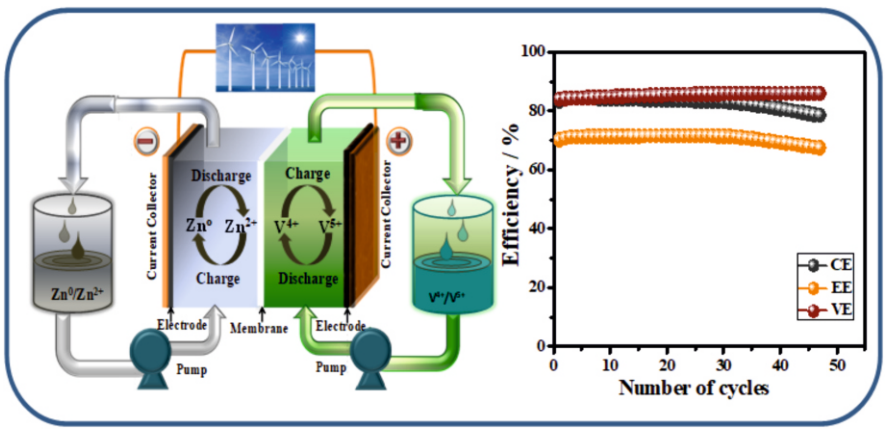


Figure. Schematic representation and the efficiency of the new Zn-V flow cell

GAP-12/17

Electrochemical biosensors for the detection of harmful chemicals in the agricultural products applications

Division(s) involved: Electrodics and Electrocatalysis

PI: Dr. Subbiah Alwarappan

Funding agency: DST-SERB, New Delhi

Duration: 10.04.2017 to 09.04.2019

Budget (Rs. in Lakh): 19.20

Objectives

- To synthesize and characterize biocompatible nanostructured iron oxide (Fe_3O_4) and reduced graphene oxide (rGO) materials
- To fabricate screen printed electrode with nano-interface for the immobilization of oxalate oxidase enzyme
- To understand the electrochemical reaction mechanism that occurs at the oxalate oxidase nanomaterial modified screen-printed electrode
- To optimize nanomaterial, scan rate, pH, incubation time, oxalate oxidase loading amount and w/v% of chitosan membrane for maximum voltammetric signal related to the nanomolar concentration of oxalate
- To investigate the analytical response characteristics of the developed nano-working electrode
- To design and develop multiple linear regression algorithms based prototype electronic tongue for the quantification of oxalate in spinach and beet greens samples

Highlights

- Proposed FTIR coupled with principal component analysis (PCA) for beetroot and dwarf copperleaf quality analysis during cold storage at 0 °C
- Quality discrimination of beetroot and dwarf copperleaf using principal component analysis
- Nonlinear regression model based on biphasic dose-response function was adopted to develop T_p time and $\int_{\bar{\nu}_i}^{\bar{\nu}_f} T_p d\bar{\nu}$ time models and the developed model could precisely detect the age of beetroot and dwarf copperleaf
- No sample pre-treatment is essential
- An accuracy of 97.5 and 99% towards predicting the beetroot and dwarf copperleaf quality, respectively
- The proposed analytical method is rapid, simple, easy to operate and suitable for continuous monitoring of age during production, storage, distribution and transportation of beetroot

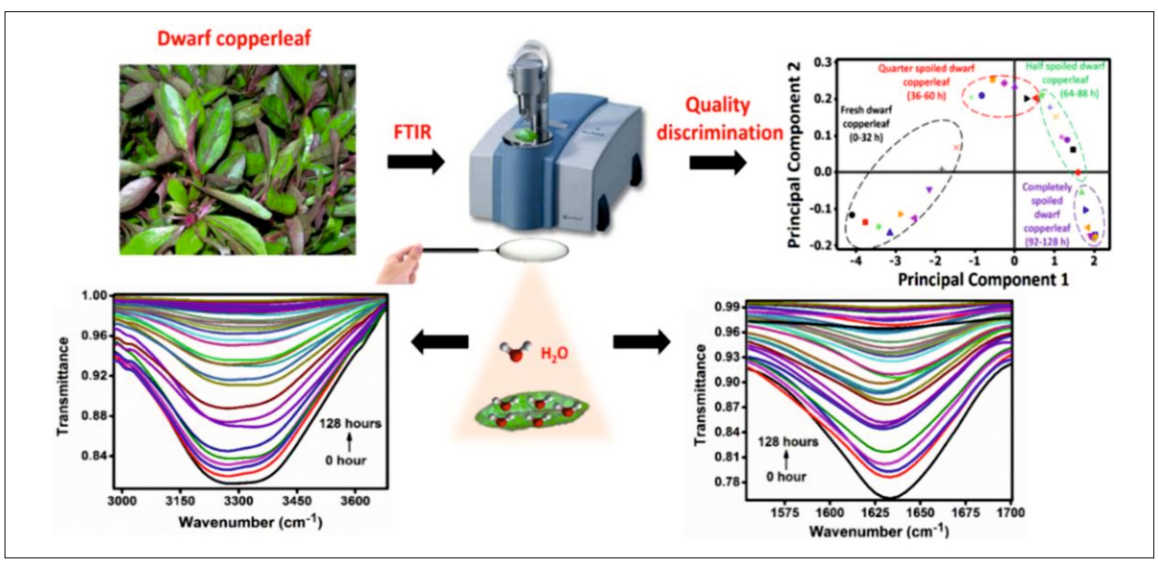


Figure. FTIR spectra of dwarf copperleaf samples recorded for a period of 5 days in the spectral ranges of 2982 – 3680 cm^{-1} and 1555 – 1700 cm^{-1} and their principal component analysis for dwarf copperleaf quality classification

GAP-16/17

Materials and related storage devices for grid deprived communities

Division(s) involved: Electrochemical Power Sources, IISc., Bengaluru & IIT, Bhubaneswar

PI: Dr. N. Kalaiselvi

Co-PI: Dr. Vijayamohanan K. Pillai

Funding agency: DST, New Delhi

Duration: 17.08.2017 to 16.08.2020

Budget (Rs. in Lakh): 60.00

Objectives

- To design and develop cost-effective nickel-iron batteries. Prototypes will be developed in association with M/s. Lifeguard Energy Technologies, Gurgaon
- To find novel catalysts based on earth-abundant, non-noble metal-based systems and electrolytes which would lead to primary as well as re-chargeable metal-air battery systems with very good characteristics. The metal-air systems that would be developed are based on zinc-air, lithium-air, and other possible chemistries
- Development of prototypes in collaboration with M/s. Amara Raja Batteries Ltd., Tirupati, for high-end applications with exceptionally high energy densities will be the ultimate goal
- To design, develop and demonstrate advanced MnO_2-based symmetric ultracapacitors and related power devices
- To develop novel electrolytes based on gel polymers
- Development of hybrid capacitors based on battery and supercapacitors

Highlights

- Corn silk derived carbon (CSC) electrode based half-cell configuration cycled between 1.5 to 4.2 V potential region stores sodium ions at the surface of carbon and delivers a capacity of 265 mA h g^{-1} at 100 mA g^{-1}
- CSC electrodes tested in asymmetric cell configuration in the form of coin and pouch cell assembly. Of the two configurations, the maximum specific energy density of 109 Wh/kg (0.324 A g^{-1}) and a power density of 12.16 kW/kg (at 2.5 A g^{-1}) are achieved at different current density conditions deployed, for the coin cell system
- The practical feasibility of the fabricated SIC energy storage system has been successfully demonstrated by lighting the blue LED for 2 min. and running a clock for 25 min.
- The superior storage behavior of CSC electrode in sodium ion capacitor could be attributed to the larger specific surface area, microporous nature of carbon, the presence of nitrogen and the suitable pore volume, which are the factors responsible to accommodating more number of sodium ions in its structure
- This work showcases a new route to develop sodium ion capacitors using a reusable activated carbon from the biowaste, bestowed with low cost

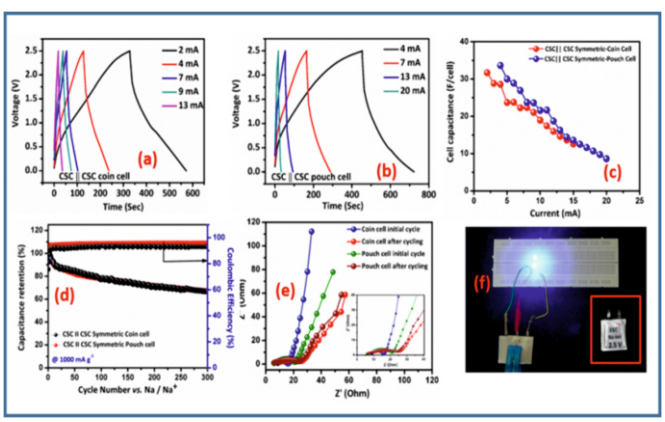


Figure. Electrochemical performance of symmetric CSC coin and pouch cell devices in the potential window 0.01 to 2.5 V in 1 M $NaClO_4$ dissolved in EC/PC (1:1 v/v) electrolyte (a, b) galvanostatic charge-discharge profile of CSC at various current (c) Rate capability studies of CSC electrode and (d) Cycling performance of symmetric CSC devices (e) EIS spectroscopy of symmetric devices corresponding to initial and after cycled at 1000 mA g^{-1} current density (f) Demonstration of pouch cell device

GAP-19/17

Metal oxides anchored graphene nanosheets for fabrication of energy storage devices

Division(s) involved: Electrochemical Power Sources & NIT, Trichy

PI: Dr. N. Kalaiselvi

Funding agency: DST-Nanomission, New Delhi

Duration: 14.09.2017 to 13.09.2020

Budget (Rs. in Lakh): 25.05

Objectives

- Ultrasound-assisted synthesis of different categories of metal oxide anchored graphene nanosheets and studying their energy efficiency for supercapacitor applications (NIT, Trichy)
- Theoretical prediction of movement of ions in fabricated supercapacitors (NIT, Trichy)
- Fabrication and performance evaluation of supercapacitors with the NIT-Trichy / CSIR-CECRI developed electrodes

Highlights

- Testing and evaluation of samples prepared at NIT, Trichy for their potential application in supercapacitors
- Inferior capacitance and cycling behavior of Mn_3O_4–GO samples received from NIT while testing with two different electrolytes viz., 6M KOH and 1M Na_2SO_4
- Analysis Mn_3O_4-GO composite through XRD (of as received and post cycled samples) analysis showed certain inherent issues with respect to purity, structure and phase stability along with conductivity issues. Suggestions provided to overcome the issues to have materials with better electrochemical performance
- Development of in-house prepared carbonaceous electrodes from Jamun shell at CSIR-CECRI for supercapacitor applications
- At a current density of 1A/g, the electrode delivers an acceptable capacitance of 130 F/g

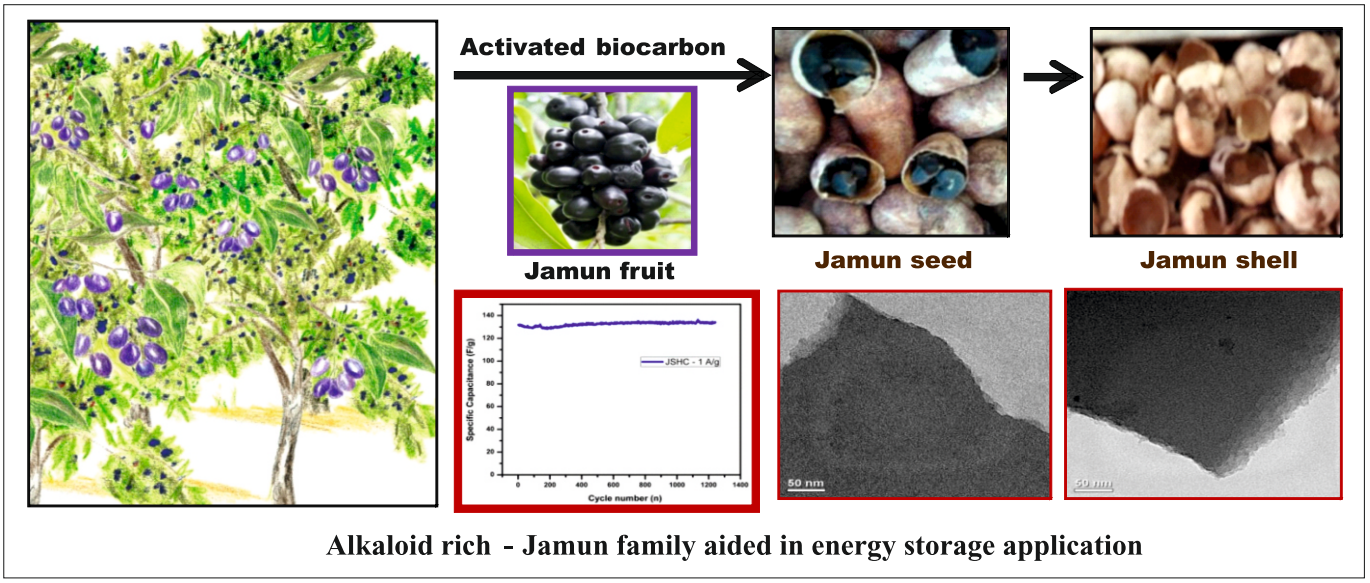


Figure. Specific capacitance vs. cycle number of the Jamun shell derived carbonaceous electrode and the pictorial representation of the preparation of carbon from Jamun shell

GAP-20/17

Development of electrochemical biosensors for neurotransmitters and clinically important biomolecules

Division(s) involved: Electrodics and Electrocatalysis

PI: Dr. Subbiah Alwarappan

Funding agency: DST-SERB, New Delhi

Duration: 11.05.2017 to10.05.2019

Budget (Rs. in Lakh): 19.20

Objectives

- Synthesis of colloidal gold nanoparticles (AuNPs) stabilized by metal-carbon bonds using spontaneous grafting of diazonium salts in an aqueous medium
- Fabrication of gold carbide bond stabilized AuNPs-CNTs composite film on the electrode surface by the potentiodynamic method
- Formation of AuNPs/CNT/electrochemically reduced graphene oxide film on a different electroactive substrate by electrografting of in-situ generated diazonium salts
- Detection and quantification of neurotransmitters (serotonin, epinephrine, and norepinephrine) and clinically important compounds (vitamins, DNA bases, amino acids, purine bases, and drugs)
- Determination of clinically important compounds in blood plasma, blood serum, and urine samples
- Fabrication of disposable sensors using screen-printed electrodes.

Highlights

- Fabricated stable graphene layers on GCE using a diazonium chemistry
- Simultaneous and selective determination of theophylline (TP) and adenosine (AD)
- Detection of 30 nM TP achieved by amperometry in human blood serum and urine samples

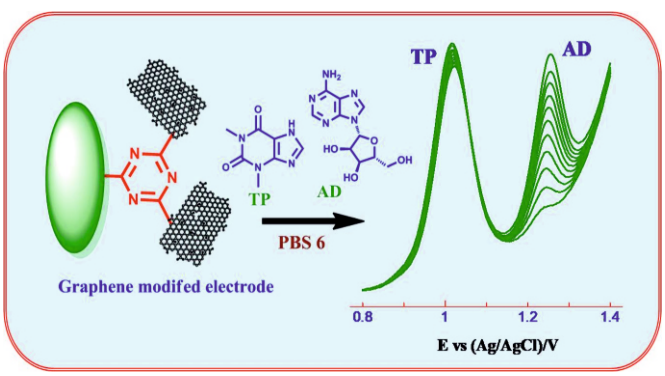


Figure. Schematic representing the electroanalysis of TP and AD at graphene modified electrode



Lecture by Prof. Takeo Yamaguchi

GAP-21/17

Wearable screen printed electrochemical devices for health and environmental monitoring, drug delivery, energy storage and energy harvesting applications

Division(s) involved: Electrodics and Electrocatalysis

PI: Dr. A.M. Vinu Mohan (DST-Inspire Faculty)

Co-PI: Dr. J. Mathiyarasu

Funding agency: DST-SERB, New Delhi

Duration: 27.04.2017 to 26.04.2022

Budget (Rs. in Lakh): 35.00

Objectives

- To develop a microfluidic device for multiplexed multianalyte detection
- To develop array of screen printed electrodes on flexible substrate
- To develop a wearable electrochemical patch for biomarker detection from body fluids, especially from sweat, saliva and interstitial fluid
- To develop wearable energy storage devices such as stretchable supercapacitor

Highlights

- Developed a flexible microfluidic patch that can direct sweat samples to the wearable sensor device
- Developed a multiarray screen-printed electrode on flexible substrate for sweat monitoring
- Microfluidic channel integrated wearable screen-printed electrode patch can continuously and non-invasively monitor biomarkers from sweat during exercising activities
- Evaluated the ability of the developed sensor for monitoring lactate, Na^+, K^+ and *p*H
- Developed serpentine-shaped screen-printed supercapacitors

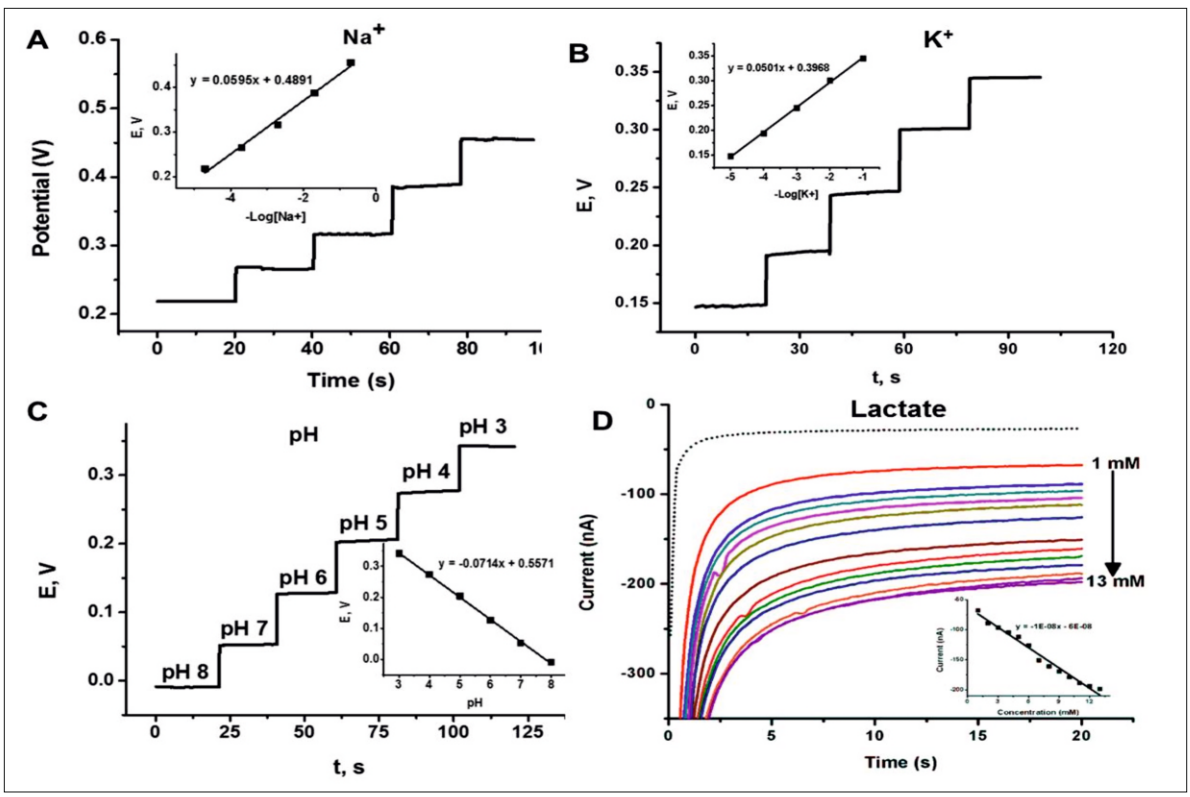


Figure. Potentiometric and amperometric detection of (A) Na^+, (B) K^+, (C) pH and (D) lactate, respectively, at flexible screen printed electrode

GAP-23/17

Exploring alternative materials for anode of lithium ion battery by first-principles calculations

Division(s) involved: Materials Electrochemistry

PI: Dr. P. Murugan

Funding agency: DST-SERB, New Delhi

Duration: 06.10.2017 to 05.10.2020

Budget (Rs. in Lakh): 29.20

Objectives

- Various silicon and germanium clusters will be modeled and decorated with lithium atoms. The interaction of clusters with CNT/graphene will be studied; structural and electronic properties of the composite will be studied in detail
- The core-shell nanostructures of silicon and carbon will be considered and the geometry and feasible mode of lithium addition, lithium diffusion path, energetics, charge transfer will be analyzed in detail followed by the electronic structure determination
- Based on the recent reports on the electrochemical activity of nano-SiC, focus will be on the electronic structure and electrochemical properties of various bulk phases and surfaces of SiC, lithiation on surfaces, and Li diffusion
- Understanding the influence of dopants such as B, N, Si, etc. on carbon nanomaterials and their effect on Li intercalation
- Different nano tubes of carbon apart from regular CNT, generally known as cyclone, will be studied with a focus on the possibility to make its assembly and Li intercalation on such assemblies

Highlights

- Structural and electronic properties of various M_4Li_n (M= Si/Ge/Sn, n = 0 - 10) show that the Si_4Li_n clusters are structurally more stable owing to their high binding energies
- Investigated the interaction between stable M_4Li_n clusters with various sized CNT and electronic and electrochemical properties of the M_4Li_n/CNT composite
- Calculations on the M_4Li_6 cluster and hydrogen capped CNT demonstrate that the encapsulation of lithiated cluster into the CNT is energetically highly favored
- The deduced electronic structures of the composite also suggest that the insertion of the lithiated cluster into CNT enhances the stability of the composite
- The Li intercalation properties of the composite determined by calculating the average intercalation voltage (AIV) infers that the CNT composite of Si_4Li_n and Ge_4Li_n have potential which is comparable to that of a CNT and proves that these nanocomposites can be used as a potential candidate for the anode of lithium ion batteries (LIBs)

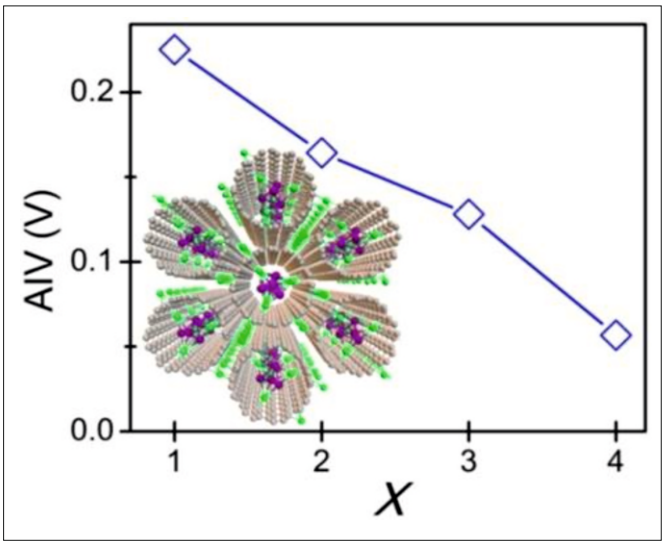


Figure. Li intercalation in the assembly formed by Si_4Li_4/(8,8) CNT composite and corresponding average intercalation voltage (AIV) profile

GAP-24/17

Photolabile nanoprobes for light-induced delivery, imaging, phototherapy, chemotherapeutics and neurogenic disorders

Division(s) involved: Materials Electrochemistry

PI: Dr. E. S. Shibu (Ramanujan Fellow)

Mentor: Dr. P. Murugan

Funding agency: DST-SERB, New Delhi

Duration: 18.09.2017 to 17.09.2022

Budget (Rs. in Lakh): 89.00

Objectives

- To develop the multimodal probes for light-induced phototherapy, light-medicated chemotherapeutics and *in situ* imaging of biological events by means of fluorescence and magnetic or photothermal optical imaging
- Combination of a nontoxic, non-blinking and NIR-fluorescent and magnetic (or plasmonic) counterparts bound with photolabile ligands would be of considerable interest for the construction of multimodal probes for safer and deep tissue imaging (florescence, MRI and photothermal imaging) in the NIR-window, clearance of nanomaterials or delivery of drug and engineered genetic materials by photo-uncaging, singlet oxygen-based phototherapy and plasmon-induced photothermal therapy in biological setting
- The concept of this proposal is based on the ability of gold quantum clusters to produce singlet oxygen, photothermal ablation effects of iron oxide nanoparticles (or plasmonic nanoparticles), and light-induced uncaging of coumarin based-bridging ligand

Highlights

- Synthesized the photosensitive coumarin molecules starting from simple organic molecules with 95% yield and their confirmation using NMR spectroscopic technique
- Covalent conjugation of a chemotherapeutic drug molecule with coumarinyl methyl ester derivatives is in progress
- Protocols for gold quantum clusters using core-reduction method and short plasmonic NIR-gold nanorods by *p*H-induced seedless method
- Au25 clusters show a characteristic band at 672 nm in absorption spectrum due to HOMO-LUMO electronic transition

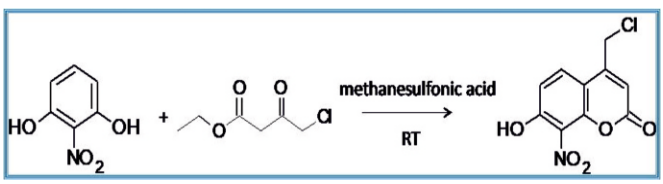


Figure. Scheme for the synthesis of substituted coumarin

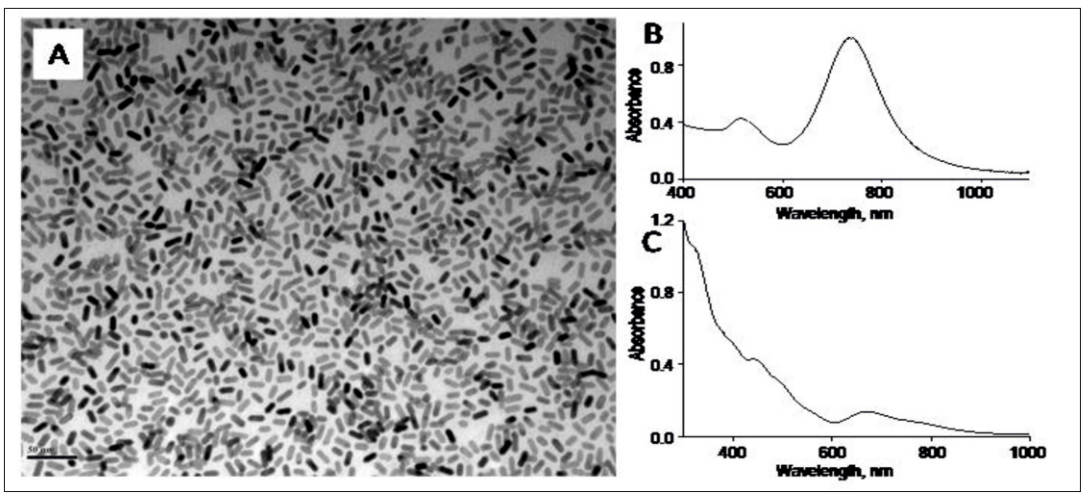


Figure. (A) TEM image and (B) the optical absorption spectrum of gold nanorod synthesized by the seedless method (C) The absorption spectrum of gold quantum clusters

GAP-25/17

Fabrication of symmetric/asymmetric high energy density supercapacitor in nonaqueous electrolytes using bio-derived/carbon nanocomposites

Division(s) involved: Materials Electrochemistry

PI: Dr. M. Sathish

Co-PI: Dr. P. Murugan

Funding agency: DST-SERB, New Delhi

Duration: 26.10.2017 to 25.10.2020

Budget (Rs. in Lakh): 30.52

Objectives

- To synthesize carbon nanocomposites using various preparation strategies (chemical activation method, physical activation method, and hydrothermal method) and the nature of starting carbon source material (bio-derived carbon)
- To synthesize activated carbon with high surface area
- To prepare various carbon materials with metal nanocomposites (metal, metal oxide and battery materials) for asymmetric supercapacitor applications

Highlights

- Supercapacitor devise with high energy and power densities of 40 Wh kg^{-1} and 150 W kg^{-1}, respectively, using *aloe vera*-derived activated carbon-based electrode materials

GAP-31/17

Novel graphene reinforced conducting polymer-metal oxide nanocomposites for supercapacitor applications

Division(s) involved: Materials Electrochemistry

PI: Dr. J. Anandha Raj (NPDF)

Mentor: Dr. M. Sathish

Funding agency: DST-SERB, New Delhi

Duration: 27.07.2017 to 26.07.2019

Budget (Rs. in Lakh): 19.20

Objectives

- The development of new graphene/conducting polymer-metal oxide nanocomposites electrode materials with controlled morphology and particle confinement with excellent storage capacity that can be used in the fabrication of supercapacitor cell
- High surface nanostructured materials will be prepared by solution growth techniques
- Light weight, low cost, stable, wearable, and higher efficiency flexible supercapacitors will be prepared to use in portable devices and also in military applications

Highlights

- Developed a novel and low-cost technology for the preparation of graphene/conducting polymer-metal oxide nanocomposites to use in flexible supercapacitor application

GAP-32/17

Heteroatom doped graphene aerogel/lithiated metal derivative composites for supercapacitor and smart electronics

Division(s) involved: Electrochemical Power Sources

PI: Dr. S. Saravanamoorthy (NPDF)

Mentor: Dr. N. Kalaiselvi

Funding agency: DST-SERB, New Delhi

Duration: 12.07.2017 to 11.07.2019

Budget (Rs. in Lakh): 19.20

Objectives

- To synthesize conducting polymer (using coupling reactions) composites with nitrogen-doped graphene, carbon nanotube and carbon nanofibers electrode materials for supercapacitor applications
- The polymer composites with carbon-based materials (graphene, carbon nanotube and carbon nanofibers) will be expected to offer more advantages, including easy preparation, high efficiency, and economical device packs
- The conducting polymer composite with nitrogen-doped carbon-based materials with improved electrochemical supercapacitor properties due to doping the heteroatom into carbon-based materials will be an effective method to improve the electrochemical property with high energy storage required to glow LEDs, and to power certain domestic and smart electronics
- Supercapacitors using conducting polymer/nitrogen-doped carbon-based nanocomposites capable of exhibiting flexibility, small size, and light-weight, and thus assume importance as efficient electronics

Highlights

- A novel conducting polymer synthesized has been used as electrode material for supercapacitor applications
- Acceptable capacitance of 40 F $cm^{-3,}$ at 1 A g^{-1} in 1.0 M KCl and cycling stability of conducting polymer composites with nitrogen-doped carbon-based materials

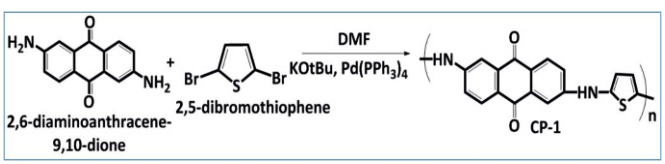


Figure. Synthesis scheme for conducting polymer

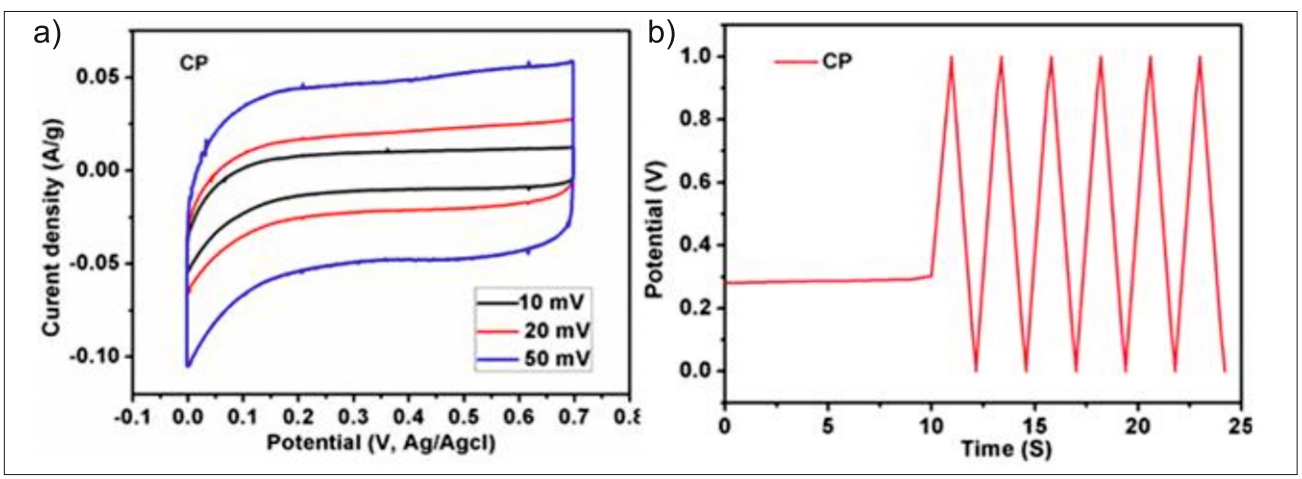


Figure. Electrochemical performance of CP supercapacitors in 1.0 M KCl electrolyte: (a) cyclic voltammograms at 50 mV s^{-1}, (b) charge/discharge curves collected at 1 A g^{-1}

GAP-34/17

Development of bio-polymer based Fe_2O_3/HNT nanocomposites for drug delivery applications

Division(s) involved: Materials Electrochemistry

PI: Dr. G. Vijayaprasath (NPDF)

Mentor: Dr. B. Subramanian

Funding agency: DST, New Delhi

Duration: 12.07.2017 to 11.07.2019

Budget (Rs. in Lakh): 19.20

Objectives

- To synthesize the Fe_2O_3 nano hollow sphere through physicochemical methods
- To formulate the composite of hollow sphere Fe_2O_3 with HNT for the purpose of encapsulation of drugs
- To combine bio-polymer with hollow Fe_2O_3/HNT without any cross-linkers using a freeze-drying method for the enhancement of mechanical strength and thermal properties and for the higher water uptake
- To load the formed composite with a different drug and to analyze the drug delivery mechanism
- To load the formed composite with a different drug and to analyze the drug delivery mechanism
- To try the different antibiotic combination with the composite to have new composite for a customized broad-spectrum or especially focused drug delivery system
- To evaluate the formed nanocomposites *in vitro* using human cell cultures and *in vivo* studies will be carried out
- To tune core-shell level of hollow sphere iron oxide/HNT nanocomposites for the application in MRI scanning as contrast agents

Highlights

- A novel, economically sustainable, targeted drug delivery system has been developed
- A facile additive-free hydrothermal route that transfers α-Fe_2O_3 nanosheets to uniform hematite α-Fe_2O_3 nano octahedra for application in drug delivery, biosensor, and energy storage devices

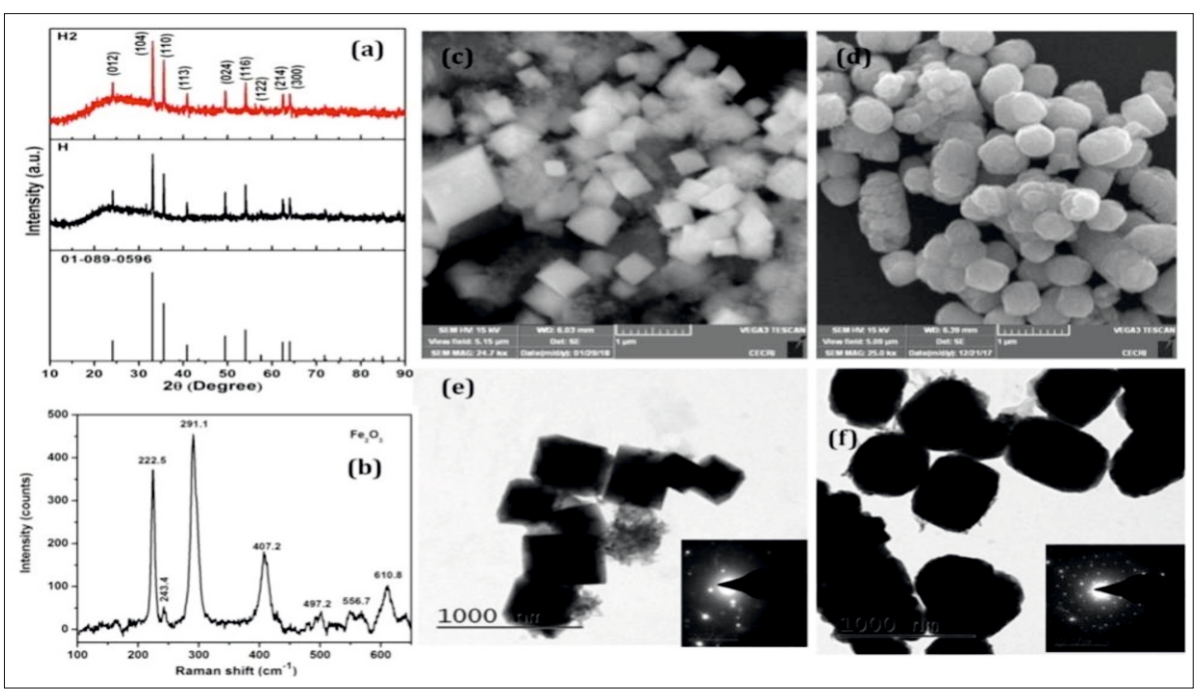


Figure. (a) Powder XRD pattern of Fe_2O_3 obtained using different reaction temperatures (160 and 180 °C), (b) Raman spectra, (c & d) SEM images and (e & f) TEM images of nanosheets and nano octahedra of α-Fe_2O_3

GAP-35/17

Prow a novel approach to design pectin coated ZnO/chitosan/hydroxyapatite biomaterials for cytotoxicity and antibacterial orthopedic implant

Division(s) involved: Process Engineering

PI: Dr. S. Ambika (NPDF)

Mentor: Dr. Deepak Kumar Pattanayak

Funding agency: DST-SERB, New Delhi

Duration: 09.08.2017 to 08.08.2019

Budget (Rs. in Lakh): 19.20

Objectives

- To synthesize and characterize hydroxyapatite, ZnO nanoparticles of controllable particle size, particle morphology, etc.
- To obtain ZnO/Hydroxyapatatite nanocomposite as well as pectin-coated ZnO/Chitosan/Hydroxyapatite as biomaterial
- Antibacterial study using *E. Coli* and cytotoxicity study using MG63 cell lines

Highlights

- ZnO NPs of different surface morphlogies and their antibacterial afficacy in gram positive bacteria (*S. aureus*)
- Biocompatible ZnO/Hydroxyapatite nanocomposites with antibacterial activity towards gram positive bacteria (*S. aureus*) revealed a significant reduction in activity after incubation for 12 hr.
- No cytotoxicity of ZnO/Hydroxyapatite nanocomposite to the MG63 cell lines

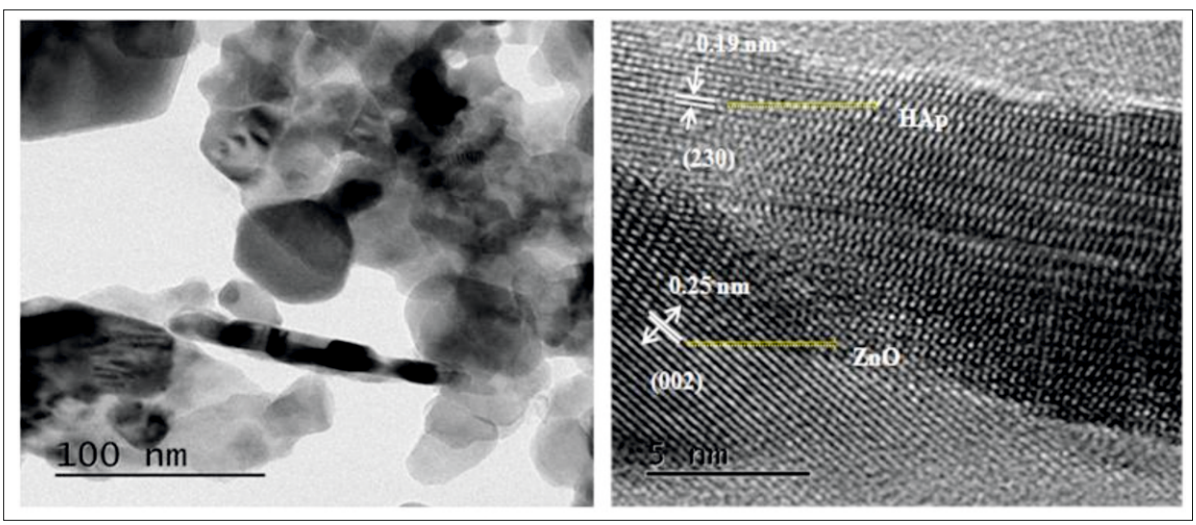


Figure. HR-TEM image of ZnO-HAp nano composite

GAP-37/17

Electrochemical immunosensor for handheld rapid detection of dengue virus infection

Division(s) involved: Electrodics and Electrocatalysis

PI: Dr. Murugan Veerapandian

Funding agency: DST, New Delhi

Duration: 17.05.2017 to 16.05.2021

Budget (Rs. in Lakh): 28.00

Objectives

- Development of novel electroactive nanomaterial as immunosensor platform
- Construction of electrode and study of electrochemical properties
- Incorporation of bio-affinity layers on electrode surface
- Immobilization of monoclonal antibodies on the electrode surface
- Electrochemical immunodetection of dengue infection associated protein

Highlights

- Dual functional, redox-active and biocompatible, electrochemical biosensor platforms based on molybdenum trioxide-Ru(II) and graphene oxide-Ru(II)
- Developed immobilization protocol for bio-affinity layer using protein-G

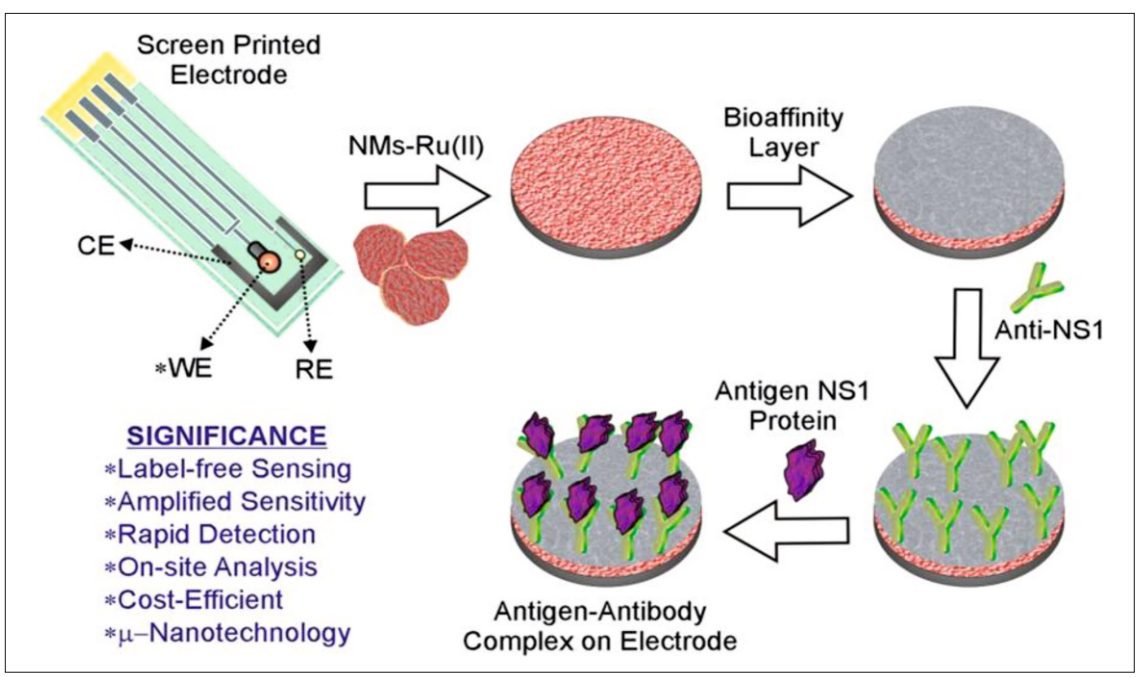


Figure. Schematic illustration of the sequential surface modification of electrode towards immunosensor studies. NMs denotes nanomaterials (molybdenum trioxide nanoparticles and graphene oxide nanosheets)

GAP-38/17

Nanomaterials as cathodes for utilization of CO_2 into value added products

Division(s) involved: Electro Organic

PI: Dr. P. Manivel (NPDF)

Mentor: Dr. V. Suryanarayanan

Funding agency: DST-SERB, New Delhi

Duration: 03.10.2017 to 02.10.2019

Budget (Rs. in Lakh): 19.20

Objectives

- Applications of metal organic framework as nanomaterials for electrocarboxylation process

Highlights

- Synthesized the protic ionic liquid (PIL), triethylammonium trifluoroacetate (TEATFA)
- Mild solution method for obtaining electro-active nickel organic framework (Ni-MOF) with about 12 μm in length and 0.7 nm in width for electrocarboxylation of benzyl bromide
- Effect of altering the compositions of the Ni-MOF-Nafion materials on the reduction and carboxylation of benzyl bromide in N, N-dimethylformamide (DMF) containing TEATFA electrolyte

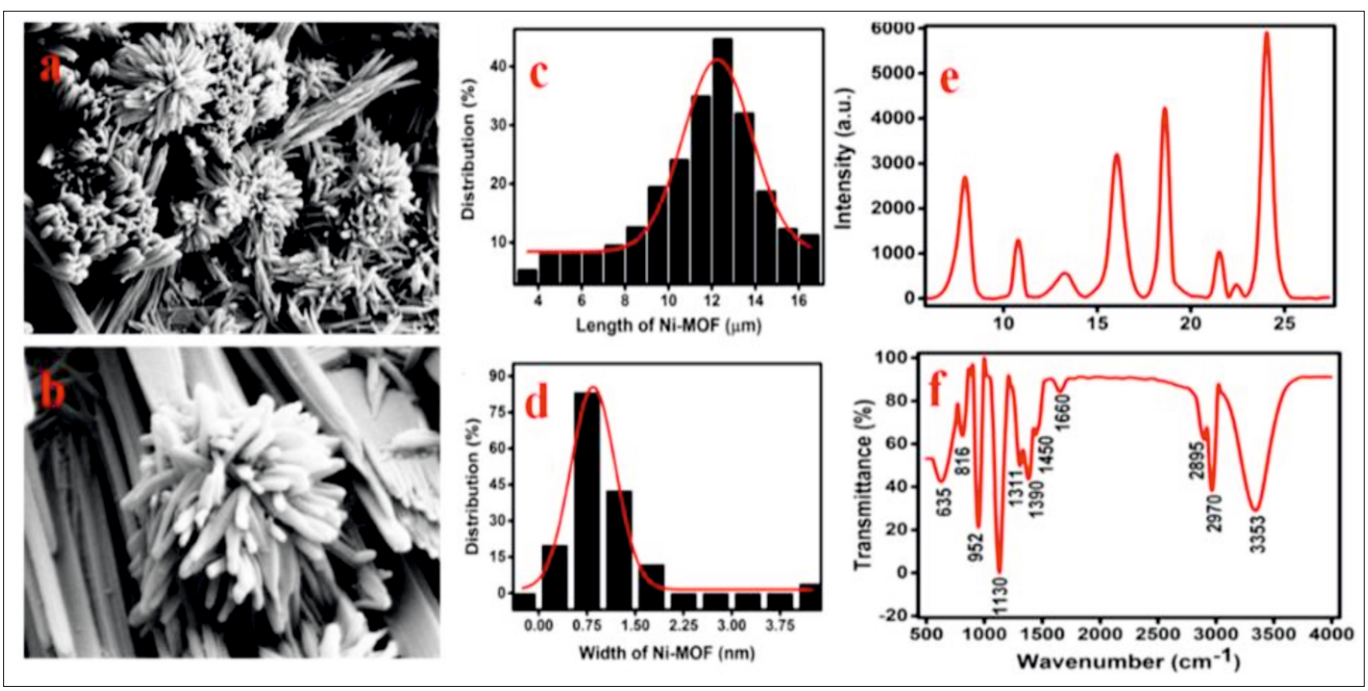


Figure. FE-SEM images of Ni-MOF at different magnifications (a) 15K and (b) 25K, distribution of Ni-MOF's (c) length and (d) width, (e) X-ray diffraction pattern and (f) the FTIR spectrum of Ni-MOF

GAP-44/17

Synthesis and electrochemical characterization of molecular imprinted polymers electrode for biosensor application

Division(s) involved: Electro Organic

PI: Dr. A. Thamilselvan (NPDF)

Mentor: Dr. V. Suryanarayanan

Funding agency: DST-SERB, New Delhi

Duration: 07.08.2017 to 06.08.2019

Budget (Rs. in Lakh): 19.20

Objectives

- Synthesis and characterization of high performance molecularly imprinted polymers (MIPs) by the electrochemical polymerization process
- Feasibility studies on MIPs materials in the presence of various organophosphate pesticides in aqueous media
- Development of the prototype sensor device for on-site detection of pesticide residues based on the feasibility studies

- Feasibility studies on MIPs materials in the presence of various organophosphate pesticides in aqueous media
- Development of the prototype sensor device for on-site detection of pesticide residues based on the feasibility studies

Highlights

- Polypyrrole-based imprinted polymers by the electrochemical polymerization process
- Vulcun carbon-multiwalled carbon nanotube (MWCNT) composite modified electrodes for detection of bisphenol-A [2,2-bis(4-hydroxyphenyl)propane] , an environmental pollutant
- Applied the proposed method to detect BPA released from plastic water bottles using the standard addition method with satisfactory recoveries

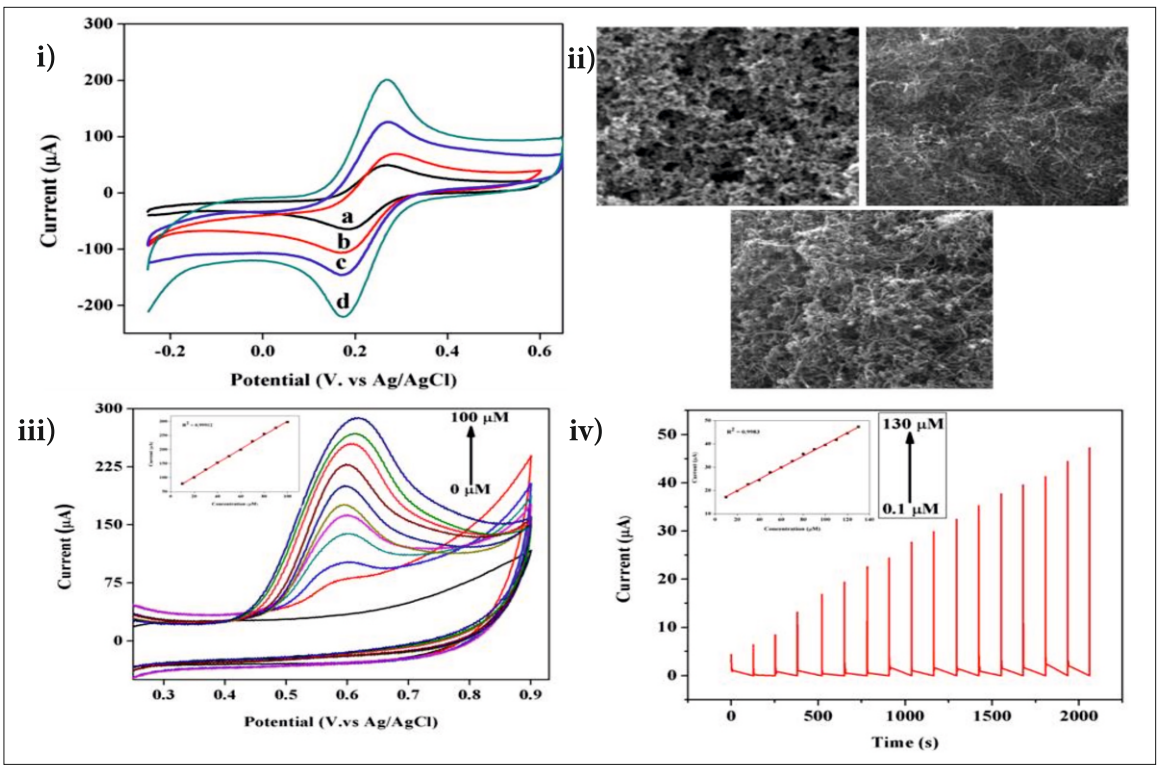


Figure. (i) Cyclic voltammograms of 5 mM $Fe(CN)_6^{3-/4-}$ (ii) SEM analysis of GC modified carbon composite electrodes. (iii) Cyclic voltammograms of different concentration of BPA and (iv) amperometric analysis of different concentration (0.1-130 uM) of BPA

GAP-45/17

Development of noble metal-free catalyst for efficient hydrogen evolution from water under visible-light and their practical implementation

Division(s) involved: Materials Electrochemistry

PI: Dr. R. Ramesh Babu (NPDF)

Mentor: Dr. M. Sathish

Funding agency: DST-SERB, New Delhi

Duration: 05.10.2017 to 04.10.2019

Budget (Rs. in Lakh): 19.20

Objectives

- Synthesis of the noble metal-free catalyst with controlled size/shape to tune the physical and photochemical properties by designing chemical and photochemical modified procedures or simple one-pot synthesis at ambient conditions
- Synthesized size- and shape-controlled metal oxide system embedded with carbon material will be explored for photocatalytic reactions, mechanistic pathway and kinetics of hydrogen evolution reaction using different experimental techniques
- Photocatalytic properties of metal oxide system are linked with carbon materials. So this noble metal-free catalyst has to be explored for the detailed study for the photocatalytic effect of H_2 production

Highlights

- Novel visible light-driven ternary composite photocatalyst CuS/ZnS/g-C_3N_4 with cauliflower-like architectures by using hydrothermal method followed by cation exchange treatment and ultrasound assisted wet impregnation method
- Highest photocatalytic hydrogen production rate (9868 µmol $h^{-1}g^{-1}$) achieved through water splitting under visible light irradiation
- Excellent durability during photocatalytic hydrogen production

GAP-46/17

Development of 2D Ti_3C_2 M Xene nanosheets based hybrid nanostructures and aerogels for electrocatalytic and energy storage applications

Division(s) involved: Electrodics and Electrocatalysis

PI: Dr. K.V. Mahesh (NPDF)

Mentor: Dr. Subbiah Alwarappan

Funding agency: DST-SERB, New Delhi

Duration: 23.10.2017 to 22.10. 2019

Budget (Rs. in Lakh): 19.20

Objectives

- Synthesis of the layered Ti_3C_2 MXenes via selective etching of 'Al' atoms with conc. HF in MAX phase, Ti_3AlC_2, obtained by heat treatments of the elemental precursors at 1350 °C/5h
- Increasing the layer separation in Ti_3C_2 MXenes via suitable intercalation of large molecules such as DMSO, t-butyl ammonium hydroxide, polyethylene imine, etc. between Ti_3C_2 layers followed by ultrasonication to obtain 2D Ti_3C_2 MXenes with less than 10 numbers of layers
- Suitably engineering the surface of 2D Ti_3C_2 MXene layers with active metal/metal oxide nanoparticles via facile chemical reactions
- Synthesis of Ti_3C_2 MXene aerogels with high surface area via gelation and freeze drying
- Testing and validation of the electrochemical performance of the developed materials

Highlights

- Ti_3AlC_2 MAX phase synthesized by heat treatments of the elemental precursors at 1350 °C/5h
- Ti_3C_2 MXenes were synthesized via HF etching as well as fluoride salt method and optimized the reaction conditions for maximum yield and completion of 'Al' removal
- The Ti_3AlC_2 powders were treated with concentrated HF acid for about 15 hr. to remove the 'A1' layer atoms through etching followed by vacuum drying
- The disappearance of non-basal plane reflections in the X-ray diffraction pattern and broadening of basal plane (002) reflection compared to the parent Ti_3AlC_2 MAX phase confirm the formation of Ti_3C_2Tx
- Texture/morphological features before and after HF treatement of Ti_3AlC_2 obtained from SEM and TEM analyses reveal the tightly stacked MAX phase layers are de-bonded and separated from each other upon HF treatment
- HF treatment produced Ti_3C_2 layers with abundant OH and F groups on the surface as confirmed by XPS analysis

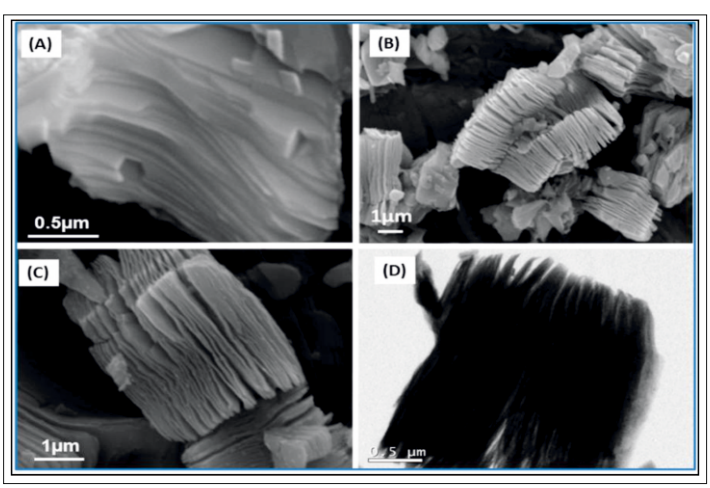


Figure. SEM images of (A) bulk Ti_3AlC_2 before HF treatment, (B and C) $Ti_3C_2T_x$ obtained after HF treatment and (D) the TEM image of $Ti_3C_2T_x$ typically showing the spread apart of single layers

GAP-47/17

Feasibility studies for the electrodeposition of aluminum on commercially available ultrafine light-weight fibers

Division(s) involved: Electroplating and Metal Finishing

PI: Dr. N. Rajasekaran

Co-PI: Dr. S. Mohan

Funding agency: DRDO, Rajasthan

Duration: 05.02.2018 to 04.08.2019

Budget (Rs. in Lakh): 09.93

Objectives

- Identification of suitable light-weight ultrafine fibers, ionic liquids/organic electrolytes and electrochemical reduction parameters for the deposition of aluminium
- Process optimization for the electrodeposition of 2-3 microns thick, unbroken and adherent layer of aluminium on the identified fibers
- Preparation of aluminium coated lightweight ultrafine fibers

Highlights

- Deposition of aluminium on copper substrate confirmed physically by the appearance of deposits
- Modifications with electrolyte composition for obtaining better electrodeposits of aluminium on copper

GAP-49/17

Vertically grown and randomly aligned one-dimensional (1D) TiO_2 and ZnO nanowires decorated with $BiVO_4$, α- Fe_2O_3 and WO_3 for photo-electrochemical and dye-sensitized solar cells

Division(s) involved: Materials Electrochemistry

PI: Dr. P. Soundarrajan (NPDF)

Co-PI: Dr. S. M. Senthil Kumar

Funding agency: DST-SERB, New Delhi

Duration: 05.10.2017 to 04.10.2019

Budget (Rs. in Lakh): 19.01

Objectives

- Vertically and randomly aligned 1D rutile/anatase mixed TiO_2 and hexagonal wurtzite ZnO nanowire thin films will be optimized on bare and/or seeded FTO and ITO (prepared by spray pyrolysis, spin coating, and sputtering techniques) substrates respectively, by using hydrothermal and chemical bath deposition (CBD) methods
- Vertically standing 1D nanowires will be used as photoanodes for fabricating DSSCs using different dye and electrolytes
- Photovoltaic parameters such as short circuit current density (J_{sc}) and open circuit voltage (V_{oc}) will be measured using solar simulator equipment and then charge carrier lifetime in assembled DSSCs will be characterized for finding the durability of the fabricated device
- Randomly aligned 1D TiO_2 and ZnO nanowires carefully decorated by $BiVO_4$, Fe_2O_3 and WO_3 metal oxides for harvesting more photons
- Fundamental physicochemical properties of prepared samples will be characterized using various characterization techniques. PEC performance will be carried out using different electrolytes.

Highlights

- The growth of nano/micro rod array (N/MRA) of hexagonal wurtzite 1D Zn thin films using facile chemical bath deposition and hydrothermal methods
- Comparison of morophology and physicochemical properties of ZnO nanorods (NRs) grown using chemical bath deposition and hydrothermal methods over ZnO seed layer deposited using spary pyrolysis method
- Crystallinity, number density and aspect ratio of ZnO NRs depend on growth method and degree of supersaturation.

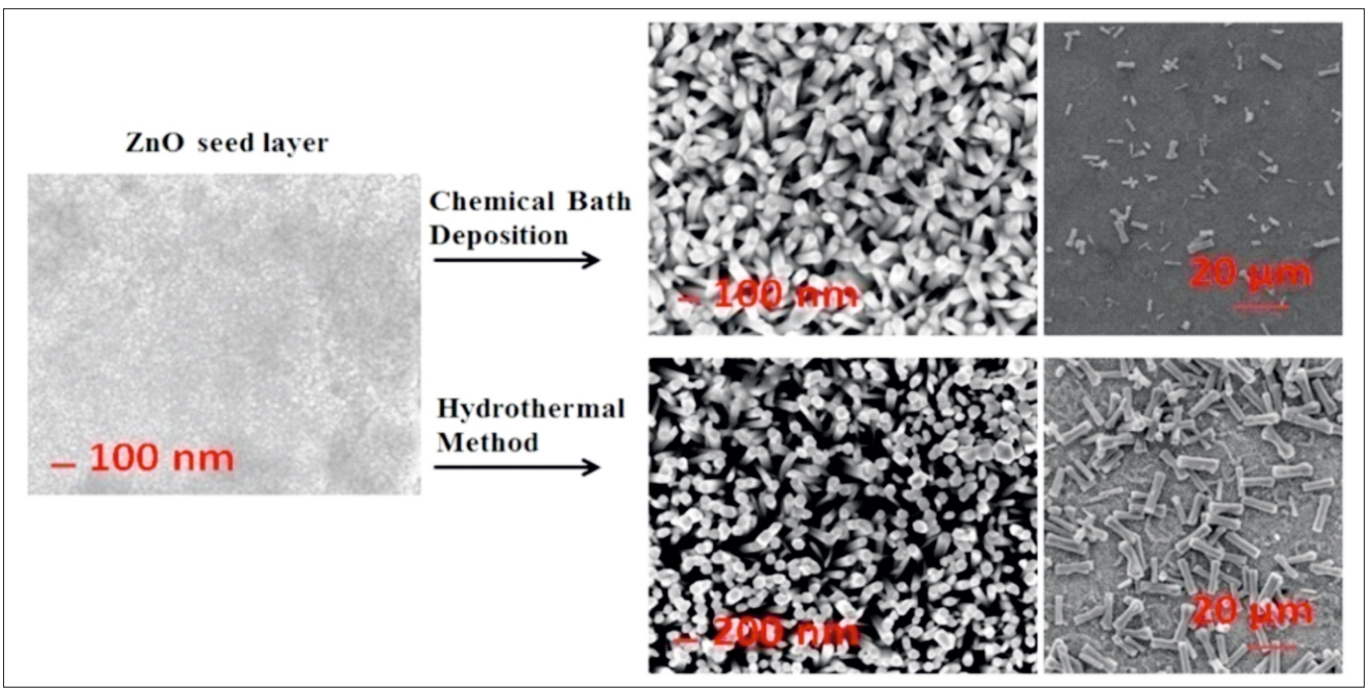


Figure. ZnO seed layer deposited by spray pyrolysis. ZnO N/MRAs grown on seed layer using CBD and hydrothermal methods



MoU between CECRI and Reliance Industries Limited

SSP-13/12

Development of multilayer wear plating composition and process - Phase I
Development of environmental friendly coating to replace hexavalent chrome plating with trivalent chrome plating multilayer plating baths - Phase II

Division(s) involved: Electroplating and Metal Finishing

PI: Dr. S. Mohan

Co-PI: Dr. Shailendra Kumar Jha

Funding agency: M/s. The Boeing Company, USA

Duration: 01.09.2012 to 30.06.2018

Budget (Rs. in Lakh): 110.00

Objectives

- Establishing a set-up for tri-chrome plating
- Development of trivalent chromium layer to a thickness of 75 micron with boric acid
- Development of trivalent chromium without boric acid
- Development of initial Fe-Cr alloy plating
- To test for the chromium deposited plates for
  - Internal surfaces
  - Bend test
  - Wear Test
  - Fatigue and hydrogen embrittlement test

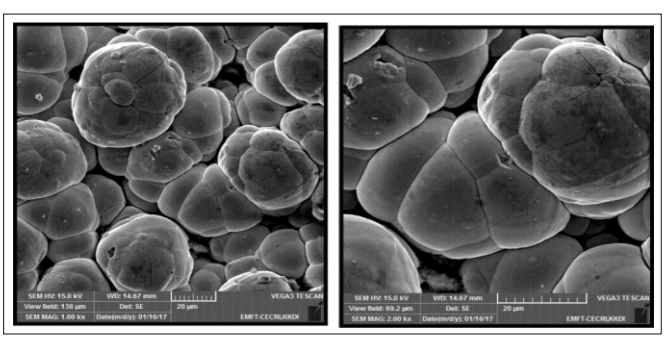


Figure. SEM image of Fe-Cr alloy deposited at pH 2.5

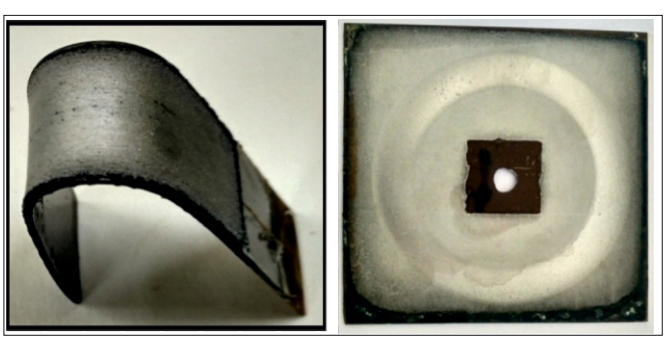


Figure. Bend and wear test of Fe-Cr coated samples (Thickness - 30µm)

Highlights

- Optimized the trivalent chromium electrolyte bath for Fe-Cr deposition by using direct current electrodeposition method
- Achieved a thickness of 75 microns on 4130 steel in three hr. and 40 microns in 1½ hr. for 100 cm^2 area
- In Fe-Cr coated sample, the bonding between the coating and the substrate is greater than the cohesive strength of either. Such adhesion reveals the good electrodeposition as witnessed from the bend test in which the sample is bent back and forth through an angle 180°

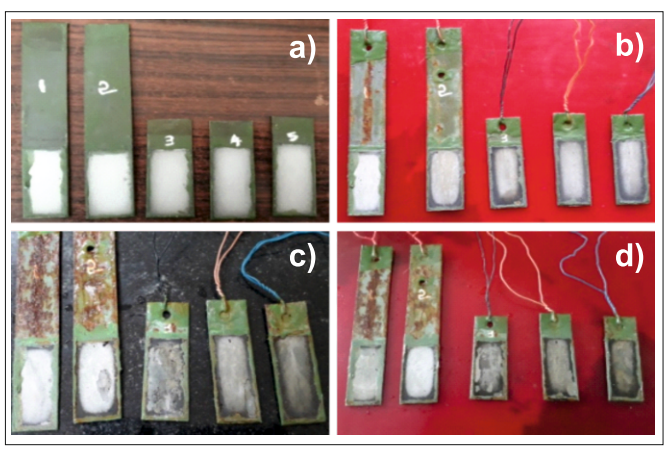


Figure. Coatings at (a) 0 hr. (b) after 24 hr. (c) after 56 hr. (d) after 100 hr. According to ASTM B537- 70 the rating for Fe-Cr alloy plated sample of thickness (30 µm) is protective rating 8

SSP-18/15

Development of conductive polymer base paint/primer coatings on aluminium alloys phase I- Feasibility study

Division(s) involved: Corrosion and Materials Protection

PI: Dr. S. Sathiyanarayanan

Co-PI: Dr. C. Arunchandran

Funding agency: M/s. The Boeing Company, USA

Duration: 11.01.2016 to 31.07.2018

Budget (Rs. in Lakh): 25.75

Objectives

- To develop an environmental friendly conducting polymer-based smart paint/primer coatings for aerospace alloys
- Recommendations submitted to Boeing, USA for implementation

Highlights

- PANI with various dopants like phosphate, benzoate, salicylate, benzotriazole, mercapto, and quinolone were synthesized
- Optimized the trichromatic passivation of AA2024
- Optimized the thickness, VOC, viscosity of paint containing Atul epoxy using a paint formulation with volume solid – 75% and PVC – 20%
- Formulation of strontium chromate-based coating and its comparison with conducting polymer-based smart coating
- Evaluated the optimized paint by using electrochemical impedance spectroscopy, pull–of–adhesion, salt-spray, abrasion, solvent–resistance and water–resistance methods
- Recommendations submitted to M/s. The Boeing Co., USA for implementation

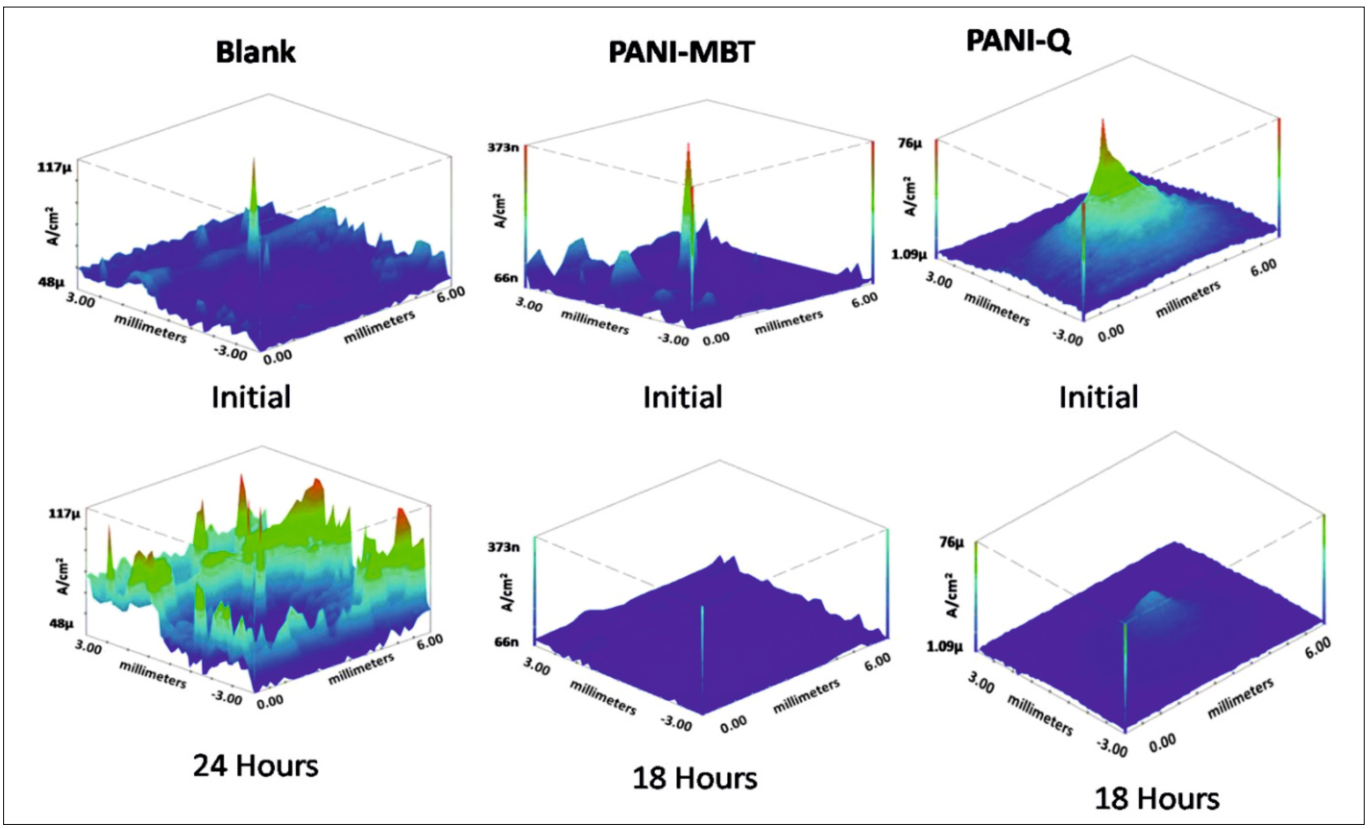


Figure. Scanning vibrating electrode technique (SVET)

SSP-04/16

Design and development of 5 numbers of higher pressure 0.5 Nm^3/h capacity PEM based water electrolyser stack for the generation of hydrogen

Division(s) involved: Process Engineering

PI: Dr. G. Sozhan

Co-PI: Dr. S. Vasudevan

Funding agency: M/s. Eastern Electrolyser Ltd., Noida.

Duration: 03.08.2016 to 31.03.2018

Budget (Rs. in Lakh): 19.94

Objectives

- Design and development of five numbers of higher pressure 0.5 Nm^3/h capacity PEM-based water electrolyser stack for the generation of hydrogen

Highlights

- Designed, fabricated and tested five numbers of higher pressure 0.5 Nm^3/h capacity PEM-based water electrolyser stack for the generation of hydrogen and dispatched to the client

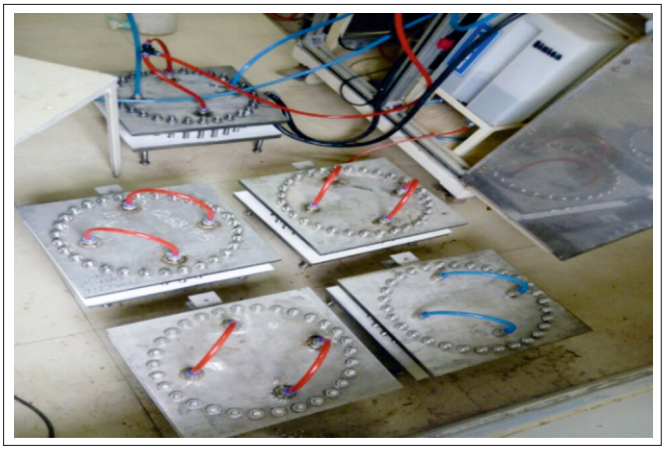


Figure. Five numbers of higher pressure 0.5 Nm^3/h capacity PEM-based water electrolyser stack for the generation of hydrogen

SSP-16/16

Development of corrosion database–phase II

Division(s) involved: Corrosion and Materials Protection

PI: Dr. S. Sathiyanarayanan

Co-PI: Dr. Rakesh C Barik

Funding agency: M/s. The Boeing Company, USA

Duration: 19.12.2016 to 18.12.2018

Budget (Rs. in Lakh): 17.02

Objectives

- Corrosion evaluation of various coatings and pretreated aluminum alloys
- Electrochemical corrosion of test materials supplied by M/s. The Boeing Co., USA to develop corrosion database

Highlights

- Phase-II of corrosion database in upon successful implementation Phase-I project

Highlights

- Phase-II of corrosion database in upon successful implementation Phase-I project
- Tested 120 aluminium test panels with 20 different surface finishes and paint coatings of surface area of 10 cm^2 supplied by Boeing, USA in 3.5% NaCl test solution at different durations
- Further testing of 60 aluminium test panels with 10 different surface finishes and paint coatings is under progress

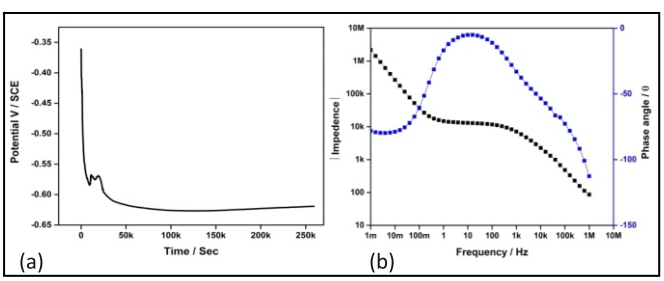


Figure. (a) OCP measured for 72 hr. (b) EIS measured for 48 hr.

SSP-21/16

Core-shell silica materials - Synthesis and characterization - Second phase of the project CLP 25/13

Division(s) involved: Process Engineering & Electro Organic

PI: Dr. Deepak Pattanayak

Co-PI: Dr. V. Suryanarayanan

Funding agency: M/s. Colgate Palmolive, USA

Duration: 03.04.2017 to 02.10.2018

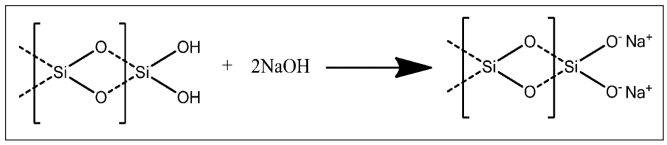
Budget (Rs. in Lakh): 30.00

Objectives

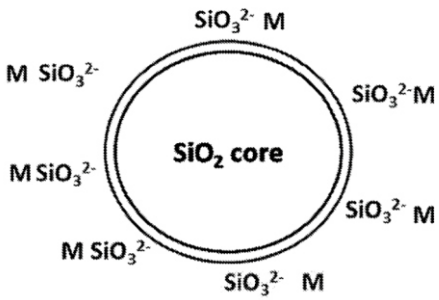
- Characterization of different silica materials supplied by M/s. Colgate Palmolive, USA
- Synthesis and characterization of
  - (i) Potassium core containing different silica shell materials
  - (ii) Zinc core containing Zeo 105 silica shell material
  - (iii) Applications for oral care formulations

Highlights

- Halitosis, (bad breath or oral malodor), a common problem due to overgrowth of oral microorganisms that produce volatile sulfur compounds (VSC), can be treated using core-shell structured colloidal particles containing Zn and K that can kill bacteria
- Core-shell particles prepared by etching silica (SiO_2) using a base (NaOH) to form Silica core-Metal silicate shell structured colloids as represented by the reaction:



The structure is represented as:



The anti-bacterial activity of silica core-metal silicate shell in the oral care formulations is under progress.



Raman Microscope

SSP-04/17

Supervising the health assessment of cross country pipelines (Crude and LPG) of CPCL, Manali

Division(s) involved: Corrosion and Materials Protection

PI: Er. S.P. Manoharan

Co-PI: Dr. S. Maruthamuthu, Dr. G. T. Parthiban, Dr. M. Selvaraj, Ms. R. Monika, Dr. S. Muralidharan and Er. K. Arumugasamy

Funding agency: M/s. Chennai Petroleum Corporation Limited, Chennai

Duration: 01.03.2017 to 31.08.2018

Budget (Rs. in Lakh): 19.84

Objectives

- To provide a comprehensive advisory work to assess the integrity and performance of the total cathodic protection system for the following two pipelines involving the system components, T/R units, ground beds, insulating flanges, coating condition etc.
  - (i) 30 inch dia & 7.5 km length of crude pipeline of CPCL, Manal
  - (ii) 10 inch dia & 3.7 km length of LPC pipeline of Ms/. CPCL, Manali

Highlights

- CSIR-CECRI as a consultant to M/s. CPCL carried out the condition survey of the pipelines and prepared the technical input for tender document for the survey work
- CIPS, DCVG.CAT and interference studies were conducted. The CP survey results revealed that the crude oil pipeline was adequately protected against external corrosion by the impressed current CP
- Suggested a new deep anode bed with MMO anode for improving the CP system of the crude oil pipeline
- Recommended a suitable coatings system for repairing the defective area
- Recommended to remove the point of metallic contact between the carrier pipe and the metal casing, the pipe or casing should be realigned using hydraulic jacks. Defective end-seals should be repaired/replaced and filled with casing filler

SSP-08/17

Durability performance of plasma coated galvanized reinforcement bars exposed in simulated and actual concrete environments

Division(s) involved: Corrosion and Materials Protection

PI: Er. K. Saravanan

Co-PI: Dr. S Muralidharan

Funding agency: M/s. Tata Steel Limited, Jamshedpur

Duration: 01.06.2017 to 31.12.2018

Budget (Rs. in Lakh): 28.75

Objectives

- The corrosion performance evaluation studies on 5 types of rebars namely a) bare steel rebar, b) galvanised rebar with plasma coating, c) epoxy coated rebar with holidays, d) nickel passivated galvanized rebar and e) hot dipped galvanized rebar will be carried out at CECRI, Karaikudi in both simulated concrete environment and also in actual concrete. The various scopes are given below.

A) Studies in simulated concrete environment.

- The performance of plasma coated galvanized rebar will, be compared with other systems of rebars using electrochemical techniques such as, impedance spectroscopy and Tafel extrapolation.

- The above tests will be carried out in different concentrations of chloride for all the five rebar systems and also in 1 % CO_2 environment for bare steel and plasma coated galvanized rebars..
- Corrosion behaviour of various rebar systems exposed in chloride and CO_2 environments will be monitored by potential – time study.
- All the above performance studies will be carried out in both pH levels such as 11 and 13.

B) Studies in actual concrete environment.

- M20 concrete specimens embedded with respective rebar systems will be examined by potential – time study for its probability of corrosion.
- The corrosion behaviour of respective rebar systems embedded in M20 concrete will be studied using electrochemical impedance spectroscopy.
- Corrosion failure i.e., cracking of RCC specimens embedded with respective rebar systems will be examined by time to cracking study.
- The above studies will be carried out in RCC specimens with two different clear covers, viz., 15 and 25 mm, four different chloride concentrations (0 to 3.5 %) for all the five rebar systems and in 1 % CO_2 condition for bare steel and plasma coated galvanized rebars
- During the above performance evaluation studies, RCC specimens embedded with respective rebar systems will be subjected to accelerated conditions such as wetting and drying in three different environmental conditions namely, rural environment, marine environment and Industrial environment.

Highlights

- The corrosion performance of galvanized and epoxy coated rebars has been carried out in 3.5% NaCl solution using electrochemical studies in simulated concrete environment. Their performance has been compared with the results of uncoated rebar. In actual concrete, it has been evaluated by time to cracking study. Typical results are presented below and further studies are in progress.

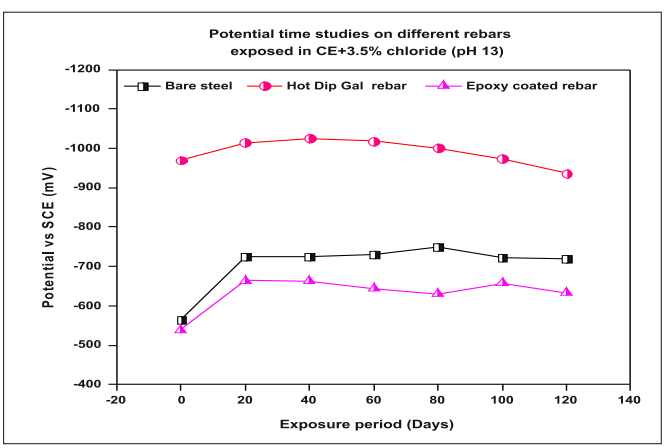


Figure. Potential time behaviour of different rebars exposed in 3.5% chloride solution

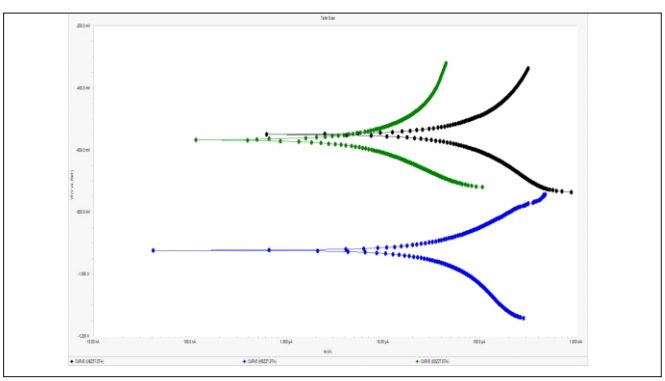


Figure. Tafel extrapolation study on different rebars exposed in 3.5% chloride solution



Figure. Time to cracking study is in progress

SSP-14/17

Development of next generation lead acid batteries for commercial applications

Division(s) involved: Electrochemical Power Sources

PI: Dr. Sundar Mayavan

Co-PI: Er. P. Seenichamy

Funding agency: M/s. Livguard Industries, Himachal Pradesh

Duration: 14.08.2017 to 13.08.2018

Budget (Rs. in Lakh): 15.00

Objectives

- Development of next-generation lead-acid batteries for commercial applications using nanomaterials

Highlights

- Next generation nanomaterials containing lead acid battery development for commercial application is in progress

SSP-26/17

Control of deposition corrosion on copper cathodes

Division(s) involved: Corrosion and Materials Protection

PI: Dr. Saranyan Vijayaraghavan

Funding agency: M/s. Minda Corporation, Noida

Duration: 30.10.2017 to 09.05.2018

Budget (Rs. in Lakh): 08.64

Objectives

- To study and analyze the black film formation on the surface of a copper electrode and find the most probable cause of its formation and comparing it to the unaffected electrode

Highlights

- Analysis of the unaffected Cu electrode
- Analysis of the blackened Cu electrode
- Collection of the blackened film formed on top of the affected Cu
- Determining the ingredients of the blackened surface from the collected sample
- Analysis of the polymer electrode holder on which the Cu electrode is embedded
- Analysis of the conductivity and stability of the grease used
- Identification of the root cause of the black layer formation on Cu
- Identification of the black coating on the surface as dicopper chloride trihydroxide, which is a non-conductive material at 12 V DC on which it is operated

SSP-27/17

Recovery of metallic tin from tin sludge by electrometallurgical process

Division(s) involved: Electroplating and Metal Finishing

PI: Dr. L. John Berchmans

Co-PI: Dr. G. Sreedhar

Funding agency: M/s. Tata Steel Ltd., Jamshedpur

Duration: 06.11.2017 to 05.11.2018

Budget (Rs. in Lakh): 25.51

Objectives

- To recover tin (Sn) from tin sludge, produced from M/s. Tata Steel Ltd, Jamshedpur (about 1.25 tones sludge/month)
- Tin plating is done by immersing steel sheets in molten tin or by electroplating
- Tin sludge is produced after tin plate, which consists of about 90% - SnO_2 with Fe, Ni, Cu and Pb impurities
- Sn is a valuable metal (Rs. 1425/-) has to be recovered by metallurgical processes such as thermal /electrowinning processes

Highlights

- Established an electrometallurgical process for the recovery of tin from tin sludge received from tin plating plant of M/s. Tata Steel Ltd.
- Compositional analysis of sludge and the determination of various metal oxides present in tin sludge.
- Separation of metal values by selective precipitation and leaching techniques.
- Leachability of tin from the sludge using different acid media namely, HCl, H_2SO_4 and HBF_4
- Preliminary studies on electro winning/refining of tin were carried out by using an electrowinning cell with suitable anode, cathode and separator system.
- Sn metal was recovered as cathode deposit using an electro winning cell.
- Tin was recovered up to 90 % from the sludge with a current efficiency of 75% and the purity of tin is 99.5%. An appreciable amount of money has been saved through this electrolytic process and also minimisation of solid waste disposal is reduced.



Figure. Experimental setup for the electro winning of tin metal from the tin sludge

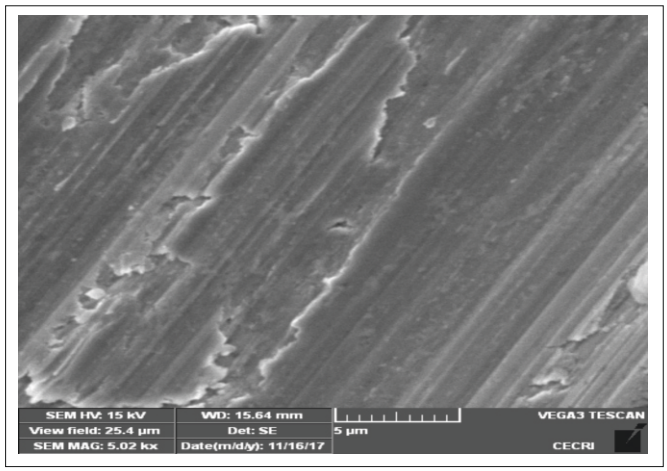


Figure. SEM image of electrodeposited tin metal

SSP-29/17

Development of advanced lead acid batteries using nanomaterials and ionic liquids

Division(s) involved: Electrochemical Power Sources

PI: Dr. Sundar Mayavan

Co-PI: Er. P. Seenichamy

Funding agency: M/s. Reliance Industries Limited, Navi Mumbai

Duration: 29.11.2017 to 28.11.2018

Budget (Rs. in Lakh): 16.00

Objectives

- Development of advanced lead-acid batteries using nanomaterials and ionic liquids

Highlights

- Nanomaterials and ionic liquids containing advanced lead acid battery development is in progress

SSP-30/17

Development of corrosion database-Phase 2A (Corrosion studies of 3D printed materials) metal powder: Ti64, Ti64ELI, Inconal 718, Inconal 625, & 4130 steel

Division(s) involved: 3D Metal Printer/ Corrosion

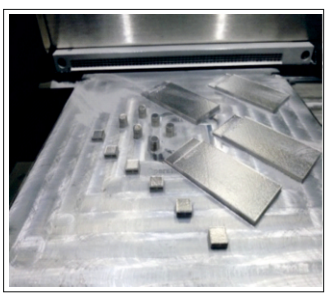
PI: Dr. S. Mohan

Co-PI: Er. Srinivasan Perumal

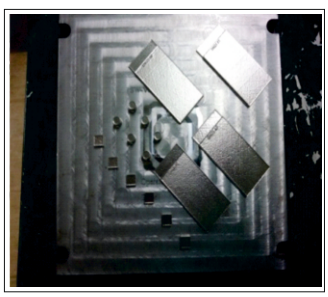
Funding agency: M/s. The Boeing Company, USA

Duration: 6.11.2017 to 05.11.2018

Budget (Rs. in Lakh): 22.56



Ti64 3D Printed test coupon



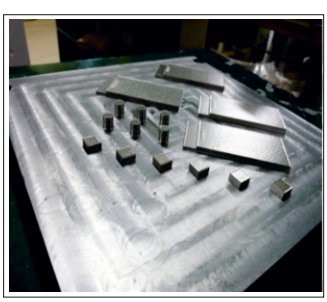
Inconal 718 3D Printed test coupon

Objectives

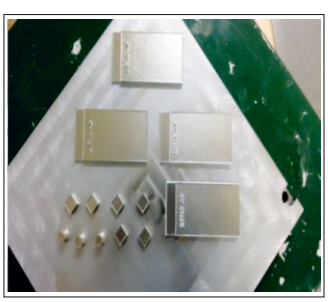
- Materials shall be 3D printed in shapes of suitable sized coupons with EOS optimized printing parameters with post processing

Highlights

- 3D Printing of test coupon from Ti64 metal powder & Standard sheet metal
- 3D Printing of test coupon from Inconal 718 metal powder& standard sheet metal
- 3D Printing of test coupon from Inconal 625 metal powder & standard sheet metal



Inconal 625 3D Printed test coupon



Ti64 3D Printed test coupon

SSP-33/17

Environmental friendly coatings: Chrome-free conductive polymer based wash primer/ etch primer

Division(s) involved: Corrosion and Materials Protection

PI: Dr. S. Sathiyanarayanan

Co-PI: Dr. C. Arunchandran

Funding agency: M/s. The Boeing Company, USA

Duration: 01.12.2017 to 31.05.2019

Budget (Rs. in Lakh): 16.16

Objectives

- To develop an environmental friendly, chrome-free conductive polymer-based wash primer/ etch primer for mild steel surfaces

Highlights

- Synthesized conducting polymer with corrosion inhibitive molecules as dopants
- Formulated the wash primer with polyvinyl butyl and conducting polymers
- Wash primer applied on mechanically polished mild steel panels with an average DFT of 8-12 µm
- Optimization of resin and inhibitive pigment concentration for best possible corrosion is in progress

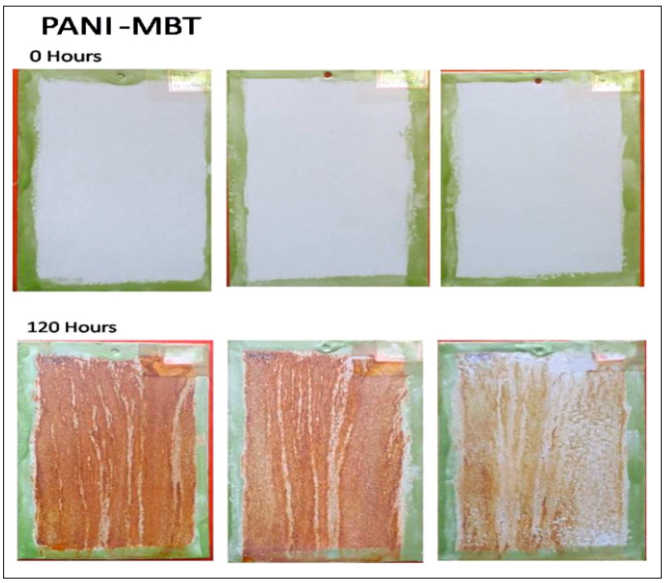


Figure. Coatings on mild steel surfaces at 0 and 120 hr.

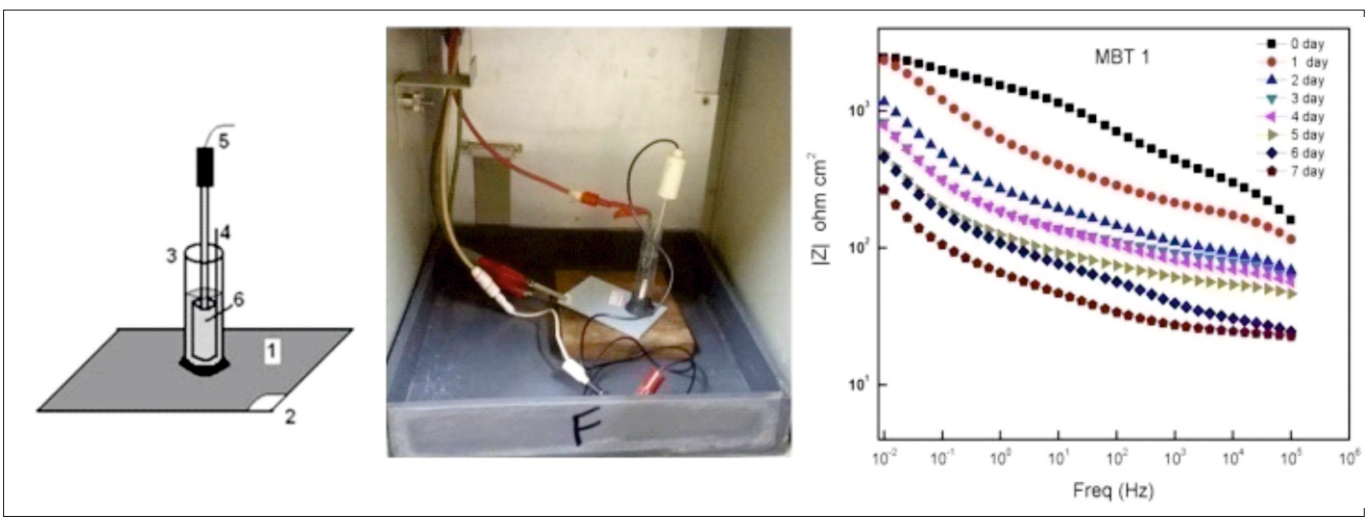


Figure. Experimental set up for EIS spectroscopy and EIS spectra curves

SSP-36/17

Electrodeposition of metals and metal oxides

Division(s) involved: Electroplating and Metal Finishing

PI: Dr. S. Mohan

Co-PI: Dr. N. Rajasekaran

Funding agency: M/s. Applied Materials, USA

Duration: 18.12.2017 to 07.12.2018

Budget (Rs. in Lakh): 10.53

Objectives

- Electrodeposition of pure, uniform, crack-free tantalum coating on Al alloys and stainless steel (SS) substrates at low fabrication temperature (< 450 °C)
- Electrodeposition of pure, uniform, crack-free yttrium coating on Al alloys by oxidation of yttrium to dense yttrium oxide by anodization or through other chemical/electro-chemical means
- Sample size is 1 cm x 1 cm with thickness of 1 to 10 m with adhesion >20MPa, no delamination, low trace metal, Cl and C contamination; 5% HCl bubble test >24 hr. for coating on Al substrate

Highlights

- Cyclic voltammetry experiments concluded electro-reduction of metallic tantalum
- Electrodeposition of metallic tantalum carried out from ionic liquids and organic solvents
- Elemental and morphological characterization of coatings were carried out.

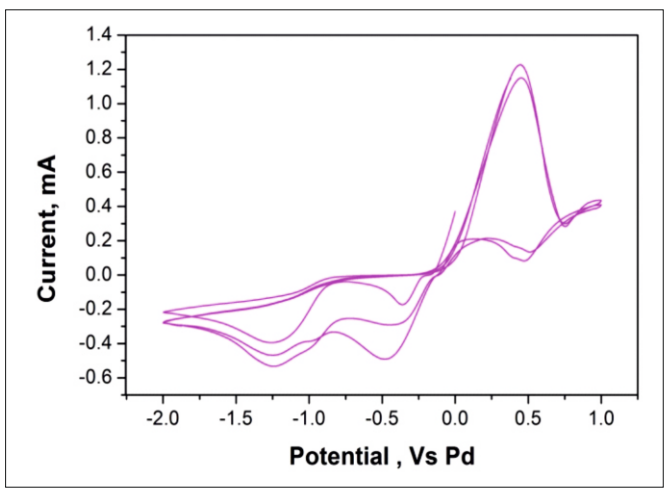


Figure. Cyclic voltammetry of tantalum fluoride in 1-butyl-1-methylpyrrolidinium bis(trifluoromethylsulfonyl)imide ionic liquid

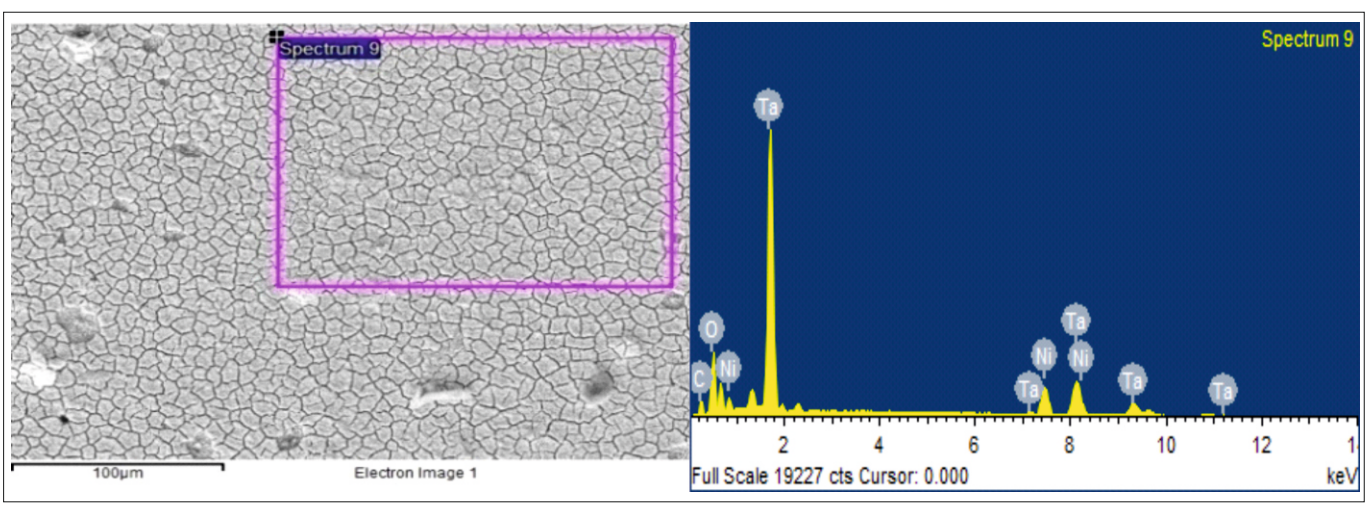


Figure. SEM and EDS results of Ta electrodeposited from ionic liquids

SSP-39/17

Design of electro-oxidation reactor for recovery of Na_2SO_4 and NaOH and reduction of COD and chlorides in effluent or RO reject water

Division(s) involved: Process Engineering & Electroplating and Metal Finishing

PI: Dr. A. Manokaran

Co-PI: Dr. C. Naveen Kumar

Funding agency: M/s. Hindustan Zinc Ltd., Udaipur

Duration: 19.12.2017 to 18.12.2018

Budget (Rs. in Lakh): 10.08

Objectives

- Reduction in RO sludge
- Generation of Na_2SO_4 with minimum chloride content
- Recovery of NaCl

Highlights

- Proof-of-concept experiments are being carried out in a 10 cm^2 electrodialysis cell to meet the above mentioned objectives

SSP-40/17

Study on the recovery of manganese as MnO_2 or Mn metal from its sulfate stream

Division(s) involved: Electroplating and Metal Finishing

PI: Dr. C. Naveen Kumar

Co-PI: Dr. Subendu Kumar Panda

Funding agency: M/s. Hindustan Zinc Ltd., Udaipur

Duration: 19.12.2017 to 18.09.2018

Budget (Rs. in Lakh): 09.70

Objectives

- Recovery of manganese (oxide or metal form) from $ZnSO_4 + MnSO_4 + MgSO_4$ mixture
- Recovery of manganese (oxide or metal form) from anode mud

Highlights

- Electrolytic grade MnO_2 has been deposited from its sulphate stream at the anode with a current efficiency of 40%
- Optimized various parameters such as temperature and current density with diverse electrode materials
- The anode mud obtained from M/s. Hindustan Zinc Ltd., has been converted to $MnSO_4$
- Conditions will be optimized for the conversion of $MnSO_4$ to metallic Mn

SSP-41/17

Removal of graphite from lead-zinc-silver beneficiation process and its conversion to graphene

Division(s) involved: Electroplating and Metal Finishing

PI: Dr. C. Naveen Kumar

Co-PI: Dr. Subendu Panda

Funding agency: M/s. Hindustan Zinc Limited, Udaipur

Duration: 19.12.2017 to 18.12.2018

Budget (Rs. in Lakh): 09.82

Objectives

- Chemical/electrochemical removal of graphite from lead-zinc-silver sludge
- Conversion of graphite to graphene using chemical and electrochemical exfoliation

Highlights

- Graphite has been recovered from lead-zinc-silver sludge chemically through solvent extraction and acid leaching

SSP-42/17

Feasibility study on the effect of impurities in lead electrolysis, having lead-fluorosilicic acid and as electrolyte, in terms of cathode quality, current efficiency and power consumption

Division(s) involved: Electroplating and Metal Finishing

PI: Dr. M. Jayakumar

Co-PI: Dr. Shailendra Kumar Jha

Funding agency: M/s. Hindustan Zinc Ltd., Udaipur

Duration: 19.12.2017 to 19.09.2018

Budget (Rs. in Lakh): 19.40

Objectives

- To study the effect of impurities in lead electrorefining having lead-fluorosilicic acid as electrolyte, as (i) cathode quality, (ii) current efficiency, (iii) power consumption
- Development of a mathematical model to understand the effect of impurities and operational parameters in lead electrolysis current efficiency improvement

Highlights

- Carried out elemental profiling of the electrolyte using in-house elemental analyzer and optimized the electrolysis conditions to understand the role of impurities on lead electrowinning
- Developed a preliminary model to understand the effect of impurities on current efficiency as per the information shared by M/s. Hindustan Zinc Ltd., Udaipur.
- Screened several impurities to understand their role on lowering the current efficiency of lead electrolysis
- Initial data indicated that the antimony (Sb) and iron (Fe) are the main culprits for the observed chaotic behavior of current efficiency which were consistent with the preliminary mathematical model developed

SSP-43/17

Development of solid film lubricants and transfer of technology

Division(s) involved: Corrosion and Materials Protection, Mandapam Unit

PI: Dr. G. Subramanian

Co-PI: Shri. R. Jeyaram

Funding agency: DRDL, Hyderabad

Duration: 15.12.2017 to 15.09. 2018

Budget (Rs. in Lakh): 15.17

Objectives

- To develop solid film lubricant coatings (SLC) and hard phosphate lubricant coating (HPLC) as per Russian specifications
- To evaluate the performance of the developed lubricant coatings as per Russian standards
- Qualification and acceptance testing of the developed products as per Russian specifications
- To demonstrate the technology of the developed products to DRDL, Hyderabad
- Technical consultation during the manufacture of first batch of the products at the agency mutually agreed between DRDL and CECRI.

Highlights

- Formulated the 504M SLC coating with molybdenum disulphide and graphite as pigment in epiphenolic resin using ethyl ketone as solvent for thinning with proper grinding
- Formulated the SLC 213 coating with molybdenum disulphide as pigment in epiphenolic resin using methyl ethyl ketone as solvent for thinning with proper grinding
- The optimization of the pigment ratio has been arrived at by permutation and combination method. The coating is applied to a cleaned and polished specimens, steel rods (150 mm length X 20 mm Dia), plain flat steel (150 mm X 100 mm X 2 mm), glass plate (75 mm X 25 mm X 2 mm) and steel disc (50 mm Dia) using air spray gun and heat treated at ambient temperature and cured.
- The thickness of the coating was found to be in the range of 10 - 12 µm
- The coatings were preserved in a desiccator (Figure) for testing of the coating's properties such as adhesion, friction coefficient and hardness



Figure. 504M solid film lubricant coatings

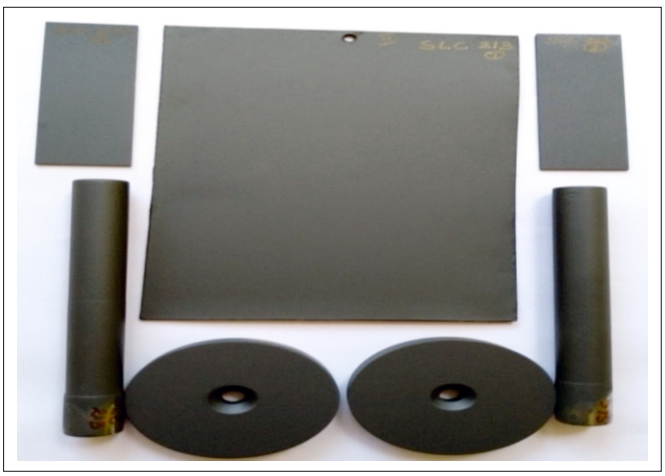


Figure. 213 solid film lubricant coatings

SSP-52/17

Sputter coating of chromium nitride (CrN) on to automotive chain pins

Division(s) involved: Materials Electrochemistry

PI: Dr. B. Subramanian

Co-PI: Dr. G. Sreedhar

Funding agency: M/s. L. G. Balakrishnan & Bros. Ltd., Coimbatore

Duration: 14.03.18 to 13.09.18

Budget (Rs. in Lakh): 17.55

Objectives

- Sputter coating of chromium nitride, chromium oxynitride, chromium carbonitride and vanadium carbonitride on automated chain pins to be provided by M/s. L. G. Balakrishnan and Bros. Ltd.
- To analyze structural and microstructural properties and composition using XRD, AFM, FESEM, XRF, and XPS
- To analyze the mechanical properties of the coatings such as adhesion, wear, nanohardness using nanoindentation

Highlights

- Deposited chromium nitride, chromium carbonitride, and vanadium carbonitride thin films by DC magnetron sputtering method in Ar^+ and N_2 atmosphere
- The reactive sputter gas used was a mixture of different ratios of Ar and N_2.
- The load *vs.* displacement curve was measured for all the samples
- For the coated film, the maximum indentation depth was 150 nm, which is less than 1/10th of the coating thickness
- After initial contact of the indenter on the surface, the load was increased at a predetermined rate (10 mN/min) to the desired maximum load (50 mN) and then decreased at the same rate (10 mN/min) to zero. The unloading curve followed the partial elastic recovery of the sample material.
- The coatings showed a nano-hardness of 21 GPa (as shown in Figure) for vanadium carbonitride coated chain pins
- The resultant data paved way to develop methods to enhance the performance of automotive chain pins with suitable coatings

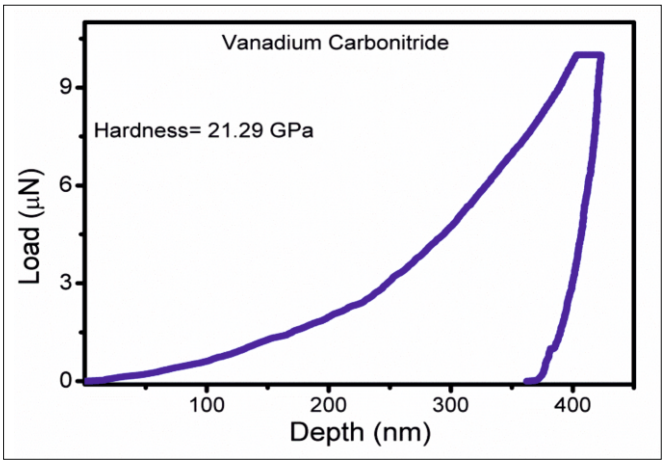


Figure. Nanoindentation on vanadium carbonitride sputtered chain pins

CLP-06/14

Development of a biosensor based assay using chicken egg yolk antibodies for rapid diagnosis of rotavirus infection

Division(s): Electrodics and Electrocatalysis

PI: Dr. Sheela Berchmans

Co-PI: Dr. A. Palaniappan

Funding agency: Indian Council of Medical Research (ICMR), New Delhi

Duration: 01.09.2013 to 01.09.2016

Budget (Rs. in Lakh): 14.54

Objectives

- Developing a rapid, highly sensitive and specific indigenous ELISA
- Developing a novel biosensor based kit using anti-VP6 chicken egg yolk antibodies for diagnosis of Group-A rotavirus infection

Highlights

- Identified and evaluated two H_2O_2 detection platforms - one approach based on a modification of glassy carbon electrode by PAMAM dendrimers and the other one was through carboxylic acid functionalized multiwalled carbon nanotubes (MWNTs; HRP conjugate)
- Demonstrated the rotavirus detection by immobilizing the rotavirus antibody onto HRP functionalized MWNTs modified glassy carbon electrode
- The feasibility of the platform was first examined with *E.coli* antigen by constructing sandwich-type *E.coli* immunosensor. The *E-coli* immunosensor with antigen shows increase in current and well-defined reduction peak than immunosensor without antigen (as shown in Figure).
- Au NPs loaded carbon surface was used to construct rotavirus immunosensor. The amount of antigen can be estimated by measuring the electrochemical response for H_2O_2 that can react with HRP conjugate bound to antigen. The H_2O_2 can be detected in the presence of either ABTS or hydroquinone to amplify the electrochemical response for enzyme (HRP) catalysis. The current changes in the presence and in the absence of antigen provide an estimate of antigen present in the sample, as shown in Figure.

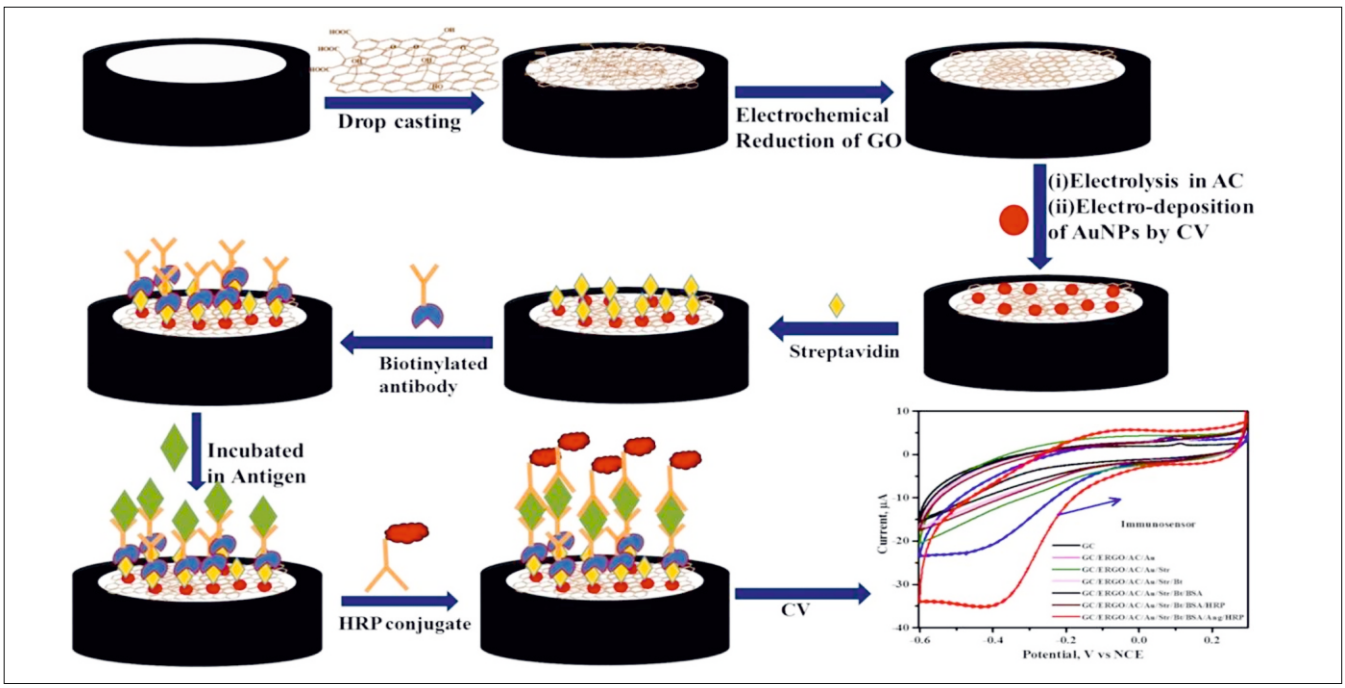


Figure. Scheme showing the stepwise construction of immunosensor

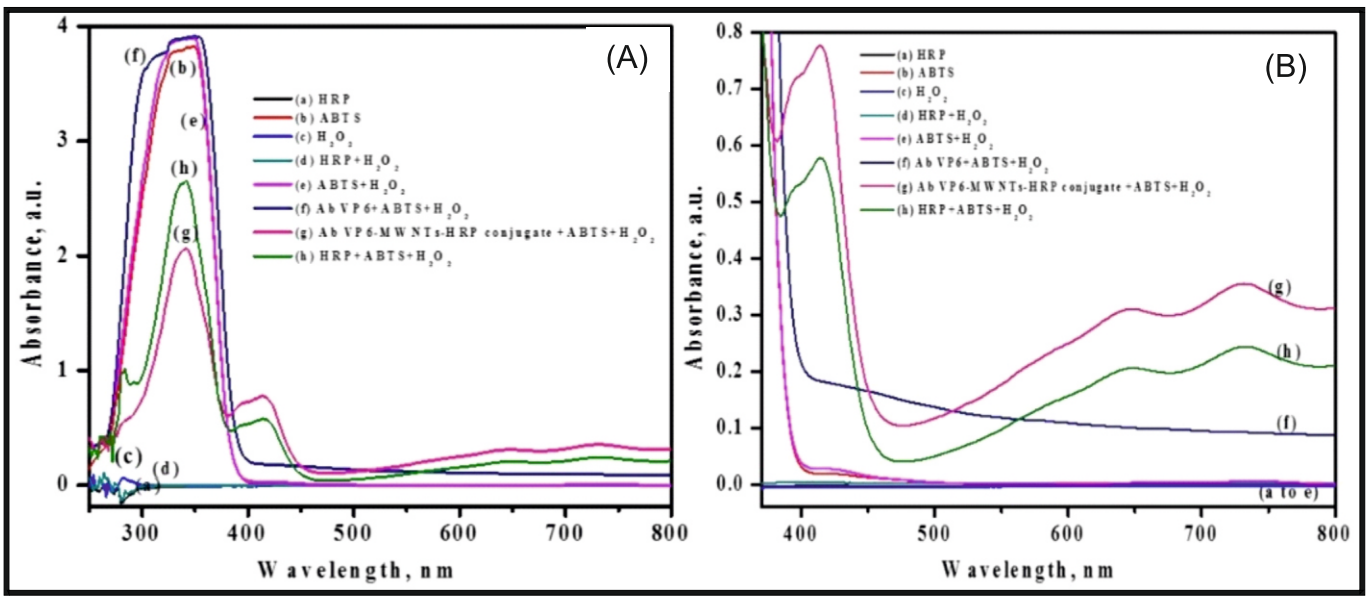


Figure. (A) The absorbance spectrum of (a) HRP, (b) ABTS, (c) H_2O_2, (d) HRP+ H_2O_2, (e) ABTS+ H_2O_2, (f) Ab VP6+ ABTS+ H_2O_2, (g)-HRP labelled Ab VP6+ ABTS+ H_2O_2 and (h) HRP+ ABTS+ H_2O_2 in PBS. (B) Enlarged view of absorbance spectrum from 350 nm to 800 nm

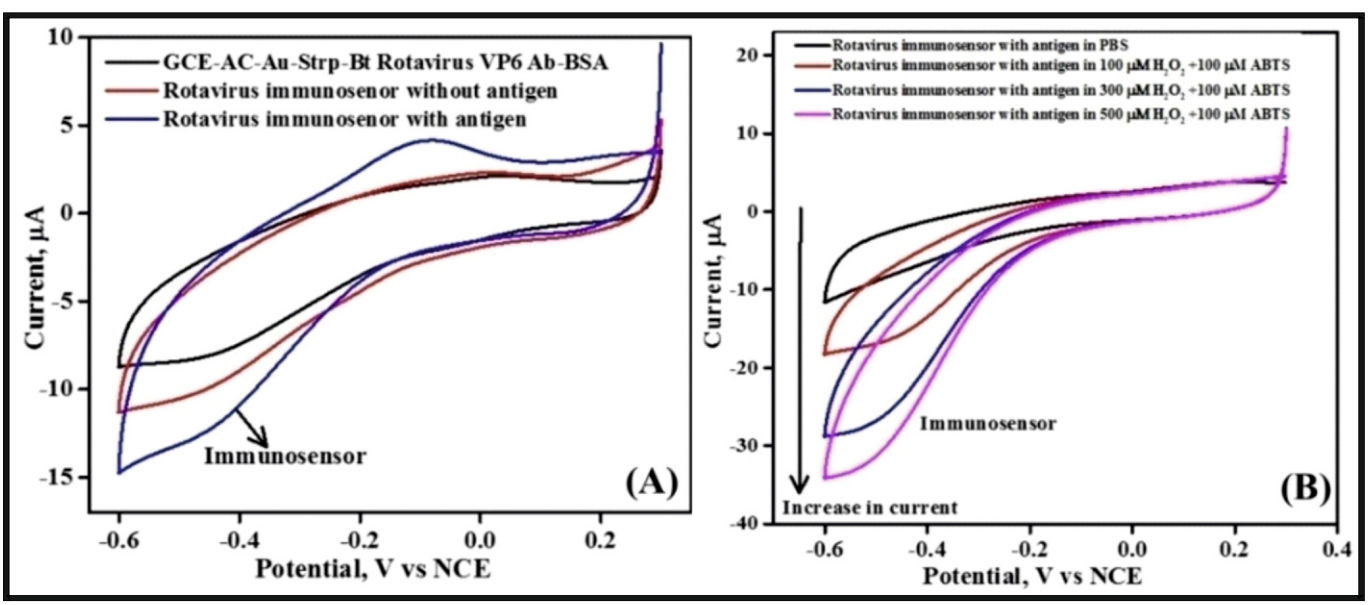


Figure. Cyclic voltammograms recorded in PBS (pH-7) solution containing 100 µM H_2O_2 and 100 µM ABTS of the electrodes mentioned in figure used as working electrode. (A) The rotavirus immunosensor based on GNPs modified AC treated GCE as a substrate and (B) the rotavirus immunosensor based on GNPs modified AC treated ERGO on GCE as a substrate

CLP-12/16

Prow investigation on the inhibition of assimilation of Ti alloy with bone marrow

Division(s): Materials Electrochemistry

PI: Dr. B. Subramanian

Co-PI: Dr. S. Maruthamuthu

Funding agency: DST, New Delhi

Duration: 11.11.2016 to 10.11.2018

Budget (Rs. in Lakh): 04.36

Objectives

- To develop Zr-based alloys of crystalline (ZrO_2) and amorphous (Zr-Ti-Si, Zr-Cu-Al-Ag, Zr-Ti-Nb-Pd) thin film metallic glasses (TFMGs) using magnetron sputtering onto orthopedic devices made of Titanium and titanium alloys (Ti-6Al-4V)
- The project will aim to optimize the fabrication of the proposed coatings with good adhesion to the substrate (bonding strength), optimal surface roughness, and low internal stress, high resistance against wear, corrosion and oxidation in order to improve the durability of the components while having a sufficient stability against detrimental attacks by the body environment
- Cell-material interaction will be explored *in vitro* using MC3T3-E1 cell lines. Cell culture experiments will be conducted including cell morphology, viability, proliferation, and calcification
- Biocompatibility will be tested by measuring the platelet adhesion, aggregation, cytotoxicity and bacterial attachment

Highlights

- Long Term: TFMG coated specimen can be used as bio-implant material owing to its biocompatible nature
- Immediate: The biodegradability of the thin film metallic glasses makes them a promising candidate in the biomedical industry as it will not possess any immune problem due to the leach out of metal ions as these ions are already present inside the human body
- A Zr-based and Ti-based metallic glass coated over a Ti bioimplant would serve the dual purpose of improving the corrosion resistance in addition to prevention of callus formation
- Investigated the glassy properties of these metallic glass thin films and their suitability for Ti implants to prevent $CaPO_4$ formation
- The SBF immersed Zr TFMG specimen showed a very low weight gain than the ZrO_2 coated specimen confirming the minimum formation of CaP on Zr TFMG
- The TFMG coated sample surface showed a smooth morphology whereas a layer growth of a crystalline aggregate of spherical particles was noticed on the SBF immersed specimens on the TFMG and ZrO_2 coated surfaces for a different period of days
- Cells cultured on Zr-MG coated samples (Figure), after 6 h, showed variable shapes and a random distribution, in contrast, cells cultured on ZrO_2 coated substrates were highly oriented
- The crimson coloration in second Figure due to the alizarin red s staining appeared on all specimens, indicating that calcified deposits formed on all surfaces. Preosteoblasts cultured on Sample B showed a similar calcification results as that by Ti.

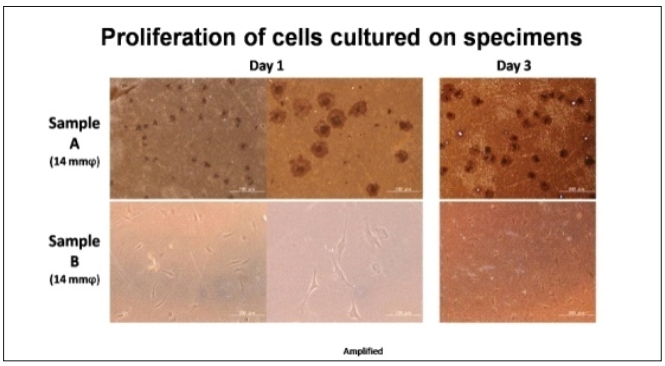


Figure. Microscopic view of cell proliferation on coated surfaces

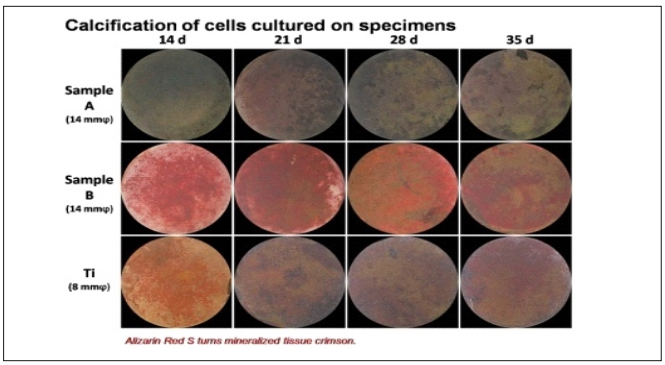


Figure. Calcification of cultured cells

TSP-04/17

Morphological analysis and characterization of lead acid battery plates

Division(s) involved: Electrochemical Power Sources

PI: Dr. Sundar Mayavan

Co-PI: Er. V. Prabhu

Funding agency: M/s. Exide Industries Ltd., Hosur

Duration: 17.05.2017 to 16.05.2018

Budget (Rs. in Lakh): 02.50

Objectives

- Morphological analysis and characterization of lead acid battery plates

Highlights

- Completed the morphological analysis of the plates and the project was completed successfully

TSP-06/17

Testing of automotive chain pins

Division(s) involved: Materials Electrochemistry

PI: Dr. B. Subramanian

Co-PI: Er. J. Kennedy

Funding agency: M/s. L. G. Balakrishnan & Bros. Ltd., Coimbatore

Duration: 28.06.17 to 31.10.17

Budget (Rs. in Lakh): 01.16

Objectives

- To analyze the chain pin samples using sophisticated instrumentation methods like XPS, FESEM, EDS, XRD, XRF, and nanohardness
- To ascertain the composition of the top layers and their hardness

Highlights

- In the case of sample A (small pin), the presence of carbon, nitrogen, chromium, and oxygen was observed along the thickness of the coating and also the EDS and XPS survey spectra of sample A (Figure) indicated a higher concentration of nitrogen in the films.
- In the case sample B (big pin), the XPS spectra showed that the top layers consisted of carbon, chromium nitrogen and oxygen whereas towards the depth of the coating the atomic percentage of carbon and oxygen reduced resulting in the presence of chromium and nitrogen alone in the first few layers adjacent to the substrate. The decrease in the concentration of elements is clearly indicated by depth profiling.
- Nanoindentation results indicated that hardness of sample B (26 GPa) was slightly higher than that of sample A (23 GPa). Similar was the case with elastic moduli of two samples, where sample B had an elastic modulus higher than that of sample A.
- The resultant data paved way to develop methods to enhance the performance of automotive chain pins with suitable coatings

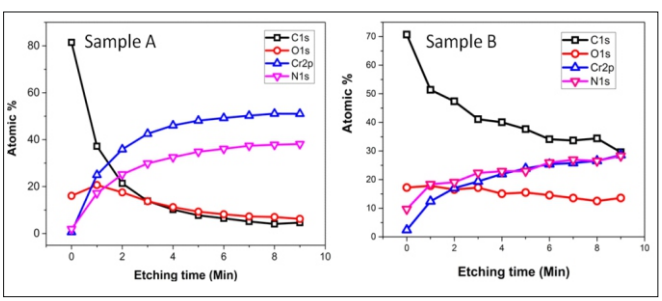


Figure. Atomic percent of elements from XPS depth profiling of sample A and B

TSP-08/17

Endurance test for 75 Ah battery as per IS 13369 :1992 specification

Division(s) involved: Electrochemical Power Sources

PI: Dr. Sundar Mayavan

Co-PI: Er. V. Muthumani

Funding agency: M/s. Sukam Industries Ltd., Gurgaon

Duration: 28.08.2017 to 28.02.2018

Budget (Rs. in Lakh): 01.50

Objectives

- Endurance Test for 75 Ah Battery as per IS 13369 :1992 specification

Highlights

- Completed the endurance test completed and project was completed successfully

TSP-10/17

Surface analysis of impregnated carbon samples using X-ray spectroscopy

Division(s) involved: Central Instrumentation Facility

PI: Er. J. Kennedy

Co-PI: Dr. V. Saranyan

Funding agency: M/s. Aqua Works Pvt. Ltd., Bengaluru

Duration : 10.10.2017 to 12.02.2018

Budget (Rs. in Lakh): 02.46

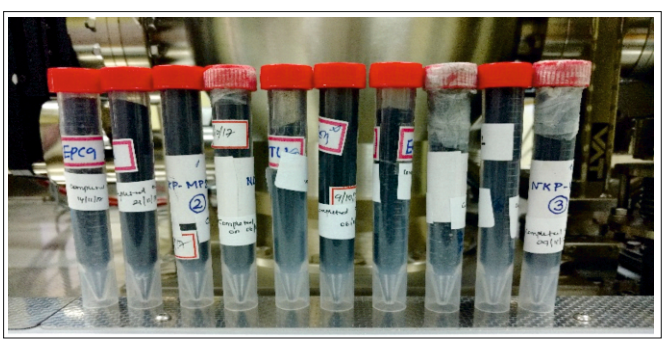


Figure. Impregnated carbon sample

Objectives

- Surface analysis of impregnated carbon sample by X-ray photoelectron spectroscopy instrument and surface compositions to be calculated from measured photoelectron peak areas in survey spectra after correction to appropriate Scofield ionization cross section by Thermo Advantage V5.967 software

Highlights

- CSIR-CECRI shall provide the XPS spectrum of each sample with atomic percentage report of an average of the five position on each sample
- Analyzed each sample for the expected and unexpected elements
- Identified the oxidization state and functional group of each sample

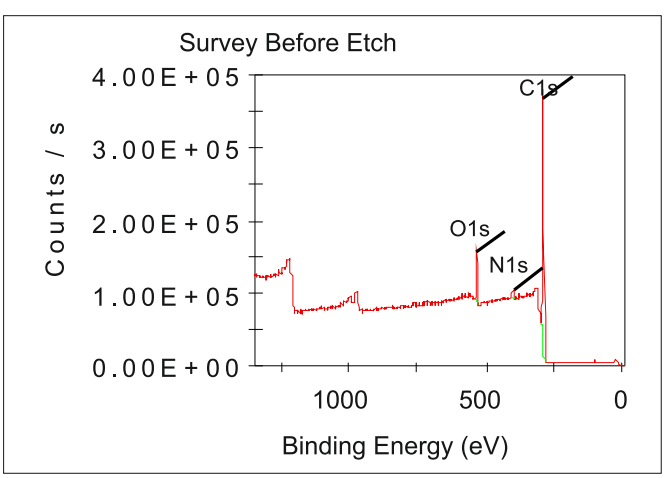


Figure. XPS spectrum of impregnated carbon sample

TSP-12/17

Battery testing 2V/500Ah LMLA cells in PPCP as per IRS:S:88/2004

Division(s) involved: Electrochemical Power Sources

PI: Er. V. Muthumani

Co-PI: Dr. Sundar Mayavan

Funding agency: M/s. Mysore Thermo Electric Pvt. Ltd., Bengaluru

Duration: 19.01.2018 to 18.01.2020

Budget (Rs. in Lakh): 06.10

Objectives

- IRS:S:88/2004 - Testing 2V/500Ah LMLA Cells

Highlights

- Testing the cells for different types of performance
- Completed the capacity test,
- Endurance and life tests are in progress

TSP-15/17

3D printing of metals

Division(s) involved: Electroplating and Metal Finishing

PI: Dr. S. Mohan

Co-PI: Er. Srinivasan Perumal

Funding agency: M/s. Wipro Enterprises, Bengaluru

Duration: 01.01.2018 to 31.12.2018

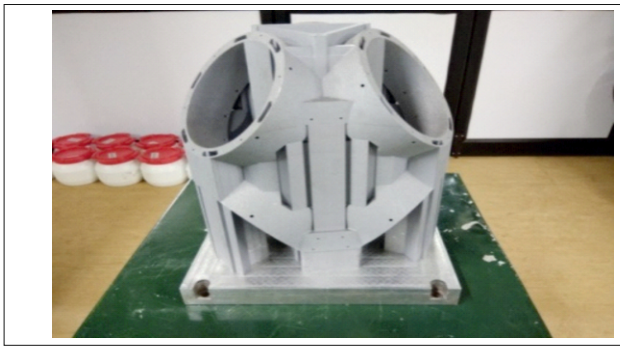
Budget (Rs. in Lakh): 26.90

Objectives

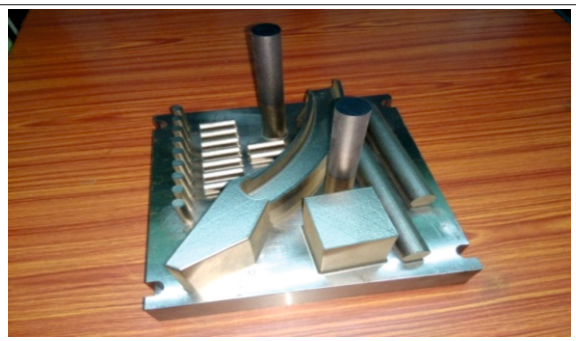
- Materials shall be 3D printed as per the 3D Model supplied by the funding agency

Highlights

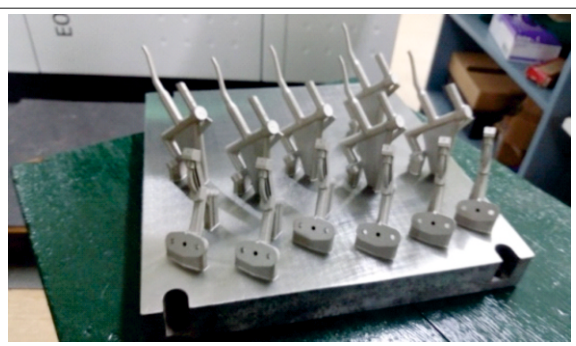
- Post treatment of 3D printed parts
- Visual inspection



Mini satellite casing



Air craft wing part



Gas turbine nozzle parts

National Accreditation Board for Testing and Calibration Laboratories

(A Constituent Board of Quality Council of India)

CERTIFICATE OF ACCREDITATION

CSIR-BATTERY PERFORMANCE TESTING AND EVALUATION CENTRE (CSIR-BPTEC), CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE (COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH)

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2005

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

CSIR-CECRI Campus, College Road, Karaikudi, Tamil Nadu

in the field of

TESTING

Certificate Number TC-5353 *(Reprinted on 27.03.2017 in lieu of T-3245)*

Issue Date 19/12/2016 **Valid Until** 18/12/2018

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.

(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Signed for and on behalf of NABL

N. Venkateswaran
Program Director

Anil Relia
Chief Executive Officer

Tailpiece...





Aerial view of CECRI

CENTRE FOR EDUCATION (CFE)

Centre for Education (CFE) was established as a part of CSIR-CECRI's human resource development programme in 1988. CSIR-CECRI runs a unique four-year B.Tech. course on Chemical and Electrochemical Engineering, approved by AICTE and affiliated to Anna University, Chennai. Admission to this programme is being made through a single window system of Tamil Nadu Engineering Admissions (TNEA) conducted every year by Anna University for 35 candidates from the home state (Tamil Nadu) and 5 for other state quota through JEE (main)–All India rank. This unique course is designed and handled by scientists and engineers of CSIR-CECRI, who possess years of research experience in their respective fields. The faculty members are extremely congenial and student-friendly, and encourage the young students to take part in research projects at their laboratories.

The exposure to advanced government-funded projects at CSIR-CECRI motivates students to take up research as a career. Moreover, they get the opportunity to publish their research in acclaimed national and international journals right at the undergraduate level. It greatly boosts their chances of admission into doctoral programme at top-ranked universities directly after the completion of B.Tech. Such a trend is evident with regard to the alumni of CSIR-CECRI, who have pursued their doctorates at universities like Oxford, Stanford, and the University of South Carolina, amongst many others. The excellent student-alumni contact is also another motivating factor for the students.

ACADEMY OF SCIENTIFIC AND INNOVATIVE RESEARCH (AcSIR)

The Academy of Scientific and Innovative Research (AcSIR) was established by an Act of Indian Parliament in 2010, for furtherance of the advancement of learning and prosecution of research in the field of science and technology (S&T) in association with the Council of Scientific and Industrial Research (CSIR) and to declare the institution known as the Academy of Scientific and Innovative Research, to be one of the national importance. The primary focus is on research and imparting instructions in areas not ordinarily taught in regular academic universities in India, by disseminating advanced knowledge in science and technology, and by providing teaching and research facilities in frontline branches of learning and emerging areas. The Academy has a structure of multi-centric institution based on a hub-and-spokes model. CSIR headquartered at New Delhi acts as a hub, which is responsible for centralized administration connected with its all 38 CSIR laboratories as spokes and act as actual campuses for different subjects/areas based on their respective specializations.

AcSIR is created to develop the highest quality professionals with cross-disciplinary knowledge, aiming to provide leaders in the field of science and technology. The academy primarily focuses on research and imparts instructions in such a manner that the methodology is novel and off the beaten track. Further, the Academy aims to:

- Nurture a research-propelled, technology-enabled, industry-linked, socially conscious higher education platform
- Achieve a seamless integration of intellectual strengths with current market needs with a people-centric focus
- Develop niche capability required to bolster research efforts in futuristic science
- Provide the opportunity to work on the frontier and contemporaneously challenging areas for nurturing innovation

AcSIR started functioning at CSIR-CECRI from January 2012. CSIR-CECRI admits the highly talented and research-oriented candidates for registering under AcSIR Ph.D. programme during January and August sessions every year. At present, 88 scholars are pursuing their Ph.D. and the details are given below:

AcSIR stream

Fellowship holders	: 61
Project Assistants	: 19
Total	: 80

University stream

Fellowship holders	: 2
Project Assistants	: 6
Total	: 8

1. Ph.D. Viva-Voce EXAMINATION COMPLETED

No.	Name	Thesis Title	Guide	Date
		AcSIR Stream		
1.	M. Raja	Ceramic-based separators for Li-ion and Li-S batteries	Dr. A. Manuel Stephan	April 28, 2017
2.	A. Muthurasu	Sensing and catalytic applications of fluorescent-based materials	Dr. V. Ganesh	May 09, 2017
3.	Bongu Chandra Sekhar	Alternative electrodes and electrolytes for lithium batteries	Dr. N. Kalaiselvi	May 31, 2017
4.	P. Subalakshmi	Transition metal oxide based electrode materials for energy storage applications	Dr. A. Sivashanmugam	August 17, 2017
5.	A. Sivasankar	Removal of organic and inorganic contaminants from the reactive dye textile effluent contaminated agricultural soil using electrokinetics	Dr. S. Maruthamuthu	August 24, 2017
6.	P. Dhandapani	Bio approach; Ureolytic bacteria mediated synthesis of multifunctional nanoparticles	Dr. S. Maruthamuthu	September 27, 2017
7.	Sumana Kundu	Synthesis and characterization of graphene-based nano-materials for energy applications	Dr. Vijayamohanan K. Pillai (Guide) Dr. P. Ragupathy (Co-Guide)	October 26, 2017
8.	S. Sathyamoorthi	Ionic liquids as electrolytes for supercapacitor	Dr. D. Velayutham	October 30, 2017
9.	Raju Thota	Chemically modified polyester film: A novel functional platform for electrochemical applications	Dr. V. Ganesh	November 15, 2017
10.	V. Selvamani	Ionic liquid electrolytes and functional carbon anodes for Li-ion battery	Dr. V. Suryanarayanan	November 15, 2017
11.	R. Karthick	Free-standing graphene-hybrid cathodes for quasi-solid-state dye-sensitized solar cells	Dr. M. Selvaraj	November 17, 2017
12.	K. Aneesh	Heterogeneous enzyme mimics for spectrophotometric and electrochemical sensing applications	Dr. Sheela Berchmans	December 13, 2017
13.	Demudu Babu Gorle	Electrochemically or chemically modified surfaces as catalytic electrodes for electrochemical applications	Dr. M. Anbukulandainathan	December 06, 2017

	Name	Thesis Title	Guide	Date
14.	R. Venkatkarthick	Design of titania electrodes for photoelectrochemical and electrochemical water splitting reaction	Dr. S. Ravichandran	December 29, 2017
15.	G. Kruthika	Computational investigations on enhancing magnetic and catalytic properties of α-mno2	Dr. P. Murugan	January 12, 2018
16.	P. Thangasamy	Supercritical fluids assisted synthesis of 2D inorganic layered materials and their applications	Dr. M. Sathish	February 26, 2018
		University Stream (Bharathidasan University, Tiruchirappalli)		
17.	A. Ananthi	Surface derivatization schemes for electrochemistry of biomolecules	Dr. K. L. N. Phani	April 05,2017
18.	N. Prabu	Studies on the synthesis and characterization of nanostructured bimetallic catalysts	Dr. D. Jeyakumar	June 09, 2017
19.	R. Pavul Raj	Studies on electrodeposition of metal/metal oxides for capacitor application	Dr. S. Mohan	August 04, 2017
20.	P. Anandha Ganesh	Facile synthesis of nanoporous materials for electrocatalytic applications	Dr. D. Jeyakumar	November 17, 2017
21.	C. Srinivasa Rao Vusa	Functionalized nanocarbons and polymer materials as versatile bio-interfaces for bioanalytical applications	Dr. Sheela Berchmans	January 23, 2018

2. Ph.D. SYNOPSIS SUBMITTED

No.	Name	Thesis Title	Guide	Date
		AcSIR Stream		
1.	K. Hemalatha	Sodium insertion compounds as electrode materials for sodium-ion batteries	Dr. A. S. Prakash	June 06, 2017
2.	J. Karthikeyan	First-principles calculations on structural stability and physicochemical properties of Mo-S nanostructures	Dr. P. Murugan	June 15, 2017
3.	Munaiah Yeddala	Development of carbon-based electrode materials and electrolyte additives for a zinc-bromine redox flow battery	Dr. Vijayamohanan K. Pillai (Guide) Dr. P. Ragupathy (Co-Guide)	July 19, 2017

No.	Name	Thesis Title	Guide	Date
4.	S. Premlatha	Electrodeposition of cobalt nanocomposites for electrochemical sensor applications	Dr. S. Mohan	October 11, 2017
5.	V. C. Soorya	Biosensing of cholesterol and glucose using bismuth-containing metal composites and inorganic-organic hybrids	Dr. Sheela Berchmans	November 03, 2017
6.	P. Remith	High capacity and high voltage electrodes for lithium batteries	Dr. N. Kalaiselvi	November 21, 2017
7.	KR. Saravanan	Ecobenign electrodes an d binder for energy storage applications	Dr. N. Kalaiselvi	November 21, 2017
8.	K. Balakumar	Carbon scaffold based cathodes for Li-S and Li-Se batteries	Dr. N. Kalaiselvi	November 21, 2017
9.	N. Mohammed Azeezulla	Discerning structure-property correlation towards the activation of small molecules	Dr. Sailaja Krishnamurthy	December 04, 2017
10.	K. Subramani	Reduced graphene oxide-based nanocomposites and bio-derived carbon for supercapacitor applications	Dr. M. Sathish	December 13, 2017
11.	C. P. Laisa	Novel lithium-rich layered cathode materials for rechargeable lithium-ion batteries	Dr. K. Ramesha	March 12, 2018
12.	S. V. Sheen Mers	Studies on some novel platforms for sensing and catalytic applications	Dr. V. Ganesh	March 21, 2018
13.	A. Priyadharshini	Electro-bio remediation strategies for effective treatment of organic-containing wastewaters	Dr. S. Maruthamuthu	March 26, 2018
14.	S. Hosimin	Recovery of valuable products from industrial waste by electrochemical processes	Dr. S. Maruthamuthu	March 27, 2018
University Stream (Bharathidasan University, Tiruchirappalli)				
15.	K. S. Anuradha	Photoanode and counter electrode modifications for improved performance of dye-sensitized solar cells	Dr. S. Mohan	April 27, 2017
16.	V. Sannasi	Studies on synthesis and characterization of new polymers for photovoltaics	Dr. D. Jeyakumar	May 02, 2017
17.	B. Venkata Rami Reddy	Electrode materials for non-aqueous alkali-ion batteries	Dr. S. Gopukumar	October 04, 2017
18.	K. Silambarasan	Interfacial architecture with nanostructured materials derived from polymeric gels for electrochemical application	Dr. James Joseph	February 07, 2018

3. Students Academic Committee (SAC)

The Students Academic Committee (SAC) had been constituted for creative mentoring of all CSIR-CECRI Ph.D. scholars. SAC looks into all issues related to the academic welfare of students in CSIR-CECRI. The Committee deals with the matters pertaining to Ph.D. admission, screening of application and interviews of Ph.D. students (if necessary), and arranging orientation programme for students who are admitted. SAC facilitates designing and implementing the coursework for all Ph.D. scholars irrespective of their registration mode (AcSIR/University) in line with the AcSIR's requirements and guidelines. SAC finds out the ways for enhancing the quality of Ph.D. students in CSIR-CECRI. The Committee also interfaces with all the respective Universities for Ph.D. registration, supervision and evaluation of the thesis, conducting viva-voce examination, etc. SAC also addresses and offers solutions to problems arising during the course of Ph.D. tenure, and facilitates healthy student-guide interactions.



Prof. Guru Row addressing the scholars during science day celebrations





Science day competitions and prize distribution

INTERNATIONAL COLLABORATION & PUBLICITY (ICP)

ACTIVITIES

Coordinating the activities on

- The deputation of CSIR-CECRI scientists to abroad under various programmes
- The visit of distinguished foreign visitors who visit CSIR-CECRI on various occasions
- Making arrangements for foreign students who visit CSIR-CECRI for carrying out their research work under various international fellowships/programmes
- Making necessary arrangements for conducting important events at the Institute
- The release of CSIR-CECRI advertisements in various media, and making arrangements for publicity in newspapers, e-information, and digital communication media
- Processes for analyzing research samples provided by external users such as academic institutions and R&D labs

Right to Information (RTI)

This activity is being carried out on the basis of Right to Information Act-2005 of the Government of India. The designated Central Public Information Officer (CPIO) responds promptly to queries on scientific and technical matters requested by the public.

1. INTERNATIONAL DEPUTATIONS



Dr. V. Saraswathy, Chief Scientist was deputed to Hanyang University, South Korea as a Visiting Professor to do research work on 'Corrosion Monitoring and Durability Assessment of Concrete Structures" at School of Architecture and Architecture Engineering Innovative Durable Building and Infrastructure Research Centre, Hanyang University, South Korea under Brain Pool Fellowship for the period from April 01, 2017 to December 31, 2017.



Dr. S. M. Senthil Kumar, Scientist was deputed to School of Chemical Engineering and Advanced Materials, Newcastle University, UK as a Visiting Researcher under DST-UKIERI joint collaborative project for carrying out research on "Development of high performance carbon nanomaterials for enhancing the cathodic oxygen reduction and performance of anode in microbial fuel cells" during May 02-16, 2017.



Dr. Sundar Mayavan, Senior Scientist was deputed to Bulgaria to make oral presentation of his research paper entitled "Effect of glycine incorporated lead oxide and non conventional nanostructured additives on the performance of lead-acid battery" in the 10th International Conference on Lead Acid Batteries (LABAT 2017) held during June 13-16, 2017 at Golden Resort, Bulgaria.

He was also deputed to Kuala Lumpur, Malaysia to make oral presentation of his research paper entitled "Carbon nanotube, glycine, boron carbon nitride and molybdenum disulfide as NAM additives on the performance of Lead acid battery" in the 17th Asian Battery Conference on Lead–Acid Batteries held at Kuala Lumpur, Malaysia during September 19-22, 2017.



Mr. K. Guruprakash, CSIR-SRF, CSIR-CECRI Madras Unit, Chennai was deputed to Singapore to make oral presentation of his paper on "An inorganic electrolyte based molten air battery with improved performance" in the 9th International Conference on Materials for Advanced Technologies (ICMAT 17) held at Suntec, Singapore during June 18-23, 2017.

INTERNATIONAL DEPUTATIONS



Mr. G. Kalaiyarasan, UGC-JRF was deputed to Russia to make poster presentation of his paper on "Cholesterol derived carbon quantum dots as fluorescence probe for haemoglobin sensor" in the Joint 16th International Symposium on Trace Elements in Man and Animals (TEMA-16), ISTERH 2017 and NTES 2017 Meeting held at Saint-Petersburg, Russia during June 26-29, 2017.



Dr. A. Manuel Stephan, Principal Scientist was deputed to Egypt for carrying out research on "Novel porous materials as electrolytes for energy devices" at Centre of Materials Science, Zewail City of Science and Technology, Giza, Egypt under Indo-Egypt Cooperative Science Programme of Joint Collaborative Project (DST-Egypt) during June 29, 2017 to July 03, 2017.

He was also deputed to Egypt for carrying out research on "Novel Porous materials as Electrolytes for Energy Devices" under Indo-Egypt Co-operative Science Programme of Joint Collaborative Project (DST-Egypt) at Centre of Materials Science, Zewail City of Science and Technology, Giza, Egypt during March 21-22, 2018.



Dr. Kuldeep Singh, Scientist was deputed to Hangzhou, China to participate in the 2nd BRICS Young Scientists Conclave held during July 11-15, 2017.



Dr. A. Palaniappan, Senior Scientist was deputed to Germany to carry out the collaborative research work entitled "Synthesis and tailoring the surface architecture of new fibre-based materials and their carbon composites for applications towards sensing analysis of pathogens, protein markers, neurotransmitters" at University of Regensburg, Germany under the CSIR –BMBF Cooperative Science Programme from August 01, 2017 to September 15, 2017.



Dr. S. Gopukumar, Senior Principal Scientist was deputed to Gyeongju, South Korea for delivering an invited talk on "Newer electrode materials for lithium/sodium ion batteries" in the 9th Asian Conference on Power Sources (ACEPS-9) held at HICO, Gyeongju, South Korea during August 20-23, 2017 and also visited to Yonsei University on August 24, 2017 to have discussion with Professor K. B. Kim.



Dr. B. Subramanian, Principal Scientist was deputed to Tokyo, Japan for carrying out research on "Investigation on the inhibition of assimilation of Ti alloy with bone marrow" at Institute of Biomaterials and Bioengineering, Tokyo Medical and Dental University, Tokyo, Japan under India-Japan Cooperative Science Programme of Joint Collaborative Project (DST-JSPS) during September 17-30, 2017.

	Dr. A. Subbiah, Senior Scientist was deputed to CNR-Rome, Italy to carry out bilateral research work on joint project proposal entitled "A Rapid high performance biosensor based on gold nanoparticle anchored graphene sheets for the electrochemical detection of biomarkers and DNA mutations for clinical and environmental applications" under the CSIR–CNR S&T Cooperative Science Programme from September 22, 2017 to October 04, 2017.
	Dr. S. Angappan, Senior Scientist was deputed to Bangkok, Thailand for Chairing a Technical Session and delivering an invited talk on "Skill development and training in science & technological sectors" in the International Science Congress Thailand 2017 (ISCTH 2017) held at Bangkok, Thailand, during October 02-06, 2017.
	Dr. Subhendu Kumar Panda, Scientist was deputed to Bonn, Germany to attend the 7th Bonn Humboldt Award Winners' Forum on "Fundamental concepts and principles of chemical energy conversion" and also for collaborative work during October 11-14, 2017.
	Mr. Remith Pongilat, Senior Research Fellow, DST-INSPIRE was deputed to Oak Brook, USA to make poster presentation of his paper on "Hallow Carbon Spheres for Lithium–Selenium Batteries" in the 10th International Conference on Advanced Lithium Batteries for Automobile Applications (ABAA-10) held in Oak Brook, IL., USA during October 22-25, 2017.
	Ms. S. Jayashree, Senior Research Fellow, DST-INSPIRE, was deputed to USA to work with Prof. Pulickel M. Ajayan, Dept. of Material Science and Engineering, Rice University, USA for the research project entitled "Architecture of defect-rich titania clusters for photoelectrochemical water splitting" under the Bhaskara Advanced Solar Energy (BASE) Internship programme supported by the DST and the Indo-US Science and Technology Forum (IUSSTF), New Delhi from March 12, 2018 to June 12, 2018.
	Dr. P. Ragupathy, Senior Scientist was deputed to Korea Advanced Institute of Science and Technology (KAIST), South Korea as visiting Scientist to work on "Development of high energy density Li-sulfur batteries" for the period from October 31, 2016 to October 30, 2017.

2. INTER-INSTITUTION AND ACADEMIC RESEARCH COLLABORATIVE WORK

Student details	Work details
Fourteen students of B.Sc./M.Sc. from various colleges and universities under IASc-INSA-NASI Summer Research Fellowship 2017 scheme	Carried out Summer Research Fellowship work under the guidance of CSIR-CECRI Scientists for eight weeks
Five Ph.D. scholars from NIT/IISER/Universities	Carried out academic/collaborative project work

3. DISSERTATION/PROJECT WORK/EXTERNAL SAMPLES ANALYSES FOR ACADEMIC INSTITUTIONS

Student details	Work details	Total Fees (Rs. in lakh)
Ninety-five students of M.Sc., M.Phil., M.E., M.Tech. in Chemistry, Physics, Materials Science, Biotechnology, Nanotechnology, Structural Engineering, Environmental Engineering, Civil Engineering, Chemical Engineering, etc. from various Universities, Arts & Science Colleges, and Engineering Colleges were permitted to carry out their dissertation-project work at CSIR-CECRI, Karaikudi and CSIR-CECRI Madras Unit, Chennai.	Carrying out project dissertation work in various disciplines November-2017 Session	6.68
Samples were analyzed using FT-IR, SEM, TEM, XPS, GPC, NMR, Thermal, HPLC, CHNS, AAS, GCMS, FESEM, EDAX, XRD, EPR/ESR etc. for academic institutions.	Analytical, spectroscopic and microscopic analyses of samples	13.13

4. INTERNATIONAL VISITORS (RESEARCH FELLOWS/SCIENTISTS)

Visitor	Details	Duration
Dr. Kehinde Olurotimi Ogunniran, Senior Lecturer, Covenant University, PMB 1023, Ota, Ogun State, Nigeria.	To avail CSIR-TWAS Fellowship for Postdoctoral Research on "Synthesis, characterization of some supramolecular metal complexes" in Functional Materials Division under the supervision of Dr. R. Thangamuthu, Principal Scientist.	July 21, 2017 – January 02, 2018
Mr. Vitalis Ikenna Chukwuike, Chemistry Laboratory Instructor, Faithcleaners Resources (NIG) Ltd. Road 24, Flat 30 Federal Low-Cost Housing Estate Rumueme, Port Harcourt, Nigeria.	To avail CSIR-TWAS Post Graduate Fellowship for pursuing research on "Erosion-corrosion inhibition of copper-based alloys under flowing conditions" in Corrosion and Material Protection (CMP) Division, under the supervision of Dr. Rakesh Chandra Barik, Scientist.	November 14, 2017 – November 13, 2021
Prof. Iren Kuznetsova, Head of Post–Graduate Study Department, Principal Scientific Researcher, Kotel'nikov Institute of Radio Engineering and Electronics of RAS, Moscow.	To deliver an invited talk on "Microenergetic Systems with Harvesting Energy" and to have discussions with CSIR-CECRI scientists	November 13-15, 2017

TECHNOLOGY TRANSFER AND BUSINESS DEVELOPMENT (TTBD)

1. CONTRACT RESEARCH PROJECTS [SPONSORED (SSP) / GRANT-IN-AID (GAP) PROJECTS]

Project No.	Sponsor	Title	Principal Investigator/ Mentor	Contract value (Rs. in lakh.)	Date of start	Duration of the project (in months)
GAP 01/17	SERB, New	Erosion and erosion-corrosion performance of electrodeposited	Rakesh C. Barik	31.13	April 03, 2017	36
GAP 02/17	SERB, New Delhi	Chemical synthesis and characterization of novel polymelamine and metal coordinated polymelamine for energy storage and generation application.	K. Senthil Kumar (PI) S. Gopukumar (Mentor)	19.20	March 01, 2017	24
GAP 03/17	DST, New Delhi	Nanoionics: Molecular design principle and charge transport in confined systems for the development of next-generation electrochemical device applications.	Karthik Krishnan (PI) B. Subramanian (Mentor)	86.27	December 14, 2016	60
SSP 04/17	Chennai Petroleum Corporation Ltd.	Supervising the health assessment of cross-country pipelines (crude and LPG) of CPCL, Manali	SP. Manoharan	22.82	April 25, 2017	07
GAP 05/17	SERB, New Delhi	Scanning tunneling microscopy studies on metalloporphyrins and phthalocyanines decorated on 2D platforms	V. Saranyan	40.49	April 19, 2017	36
GAP 06/17	SERB, New Delhi	Electrodeposition of silver, gold, brass and some of the refractory metal from ionic liquids and assessment of these deposits in the electrocatalysis and industrial applications	Shailendra K. Jha	23.07	April 01, 2017	36

Project No.	Sponsor	Title	Principal Investigator/ Mentor	Contract value (Rs. in lakh.)	Date of start	Duration of the project (in months)
SSP 07/17	Oil India Limited	Corrosion control for formation water disposal lines	G. T. Parthiban	9.81	May 11, 2017	06
SSP 08/17	Tata Steel Limited	Durability performance of plasma coated galvanized reinforcement bars exposed in simulated and actual concrete environments.	K. Saravanan	28.75	June 01, 2017	15
SSP 09/17	Godrej and Boyce Manufacturing Company Ltd	Studies on stress corrosion and hydrogen embrittlement behaviour of PH stainless steels	G. T. Parthiban	12.76	June 19, 2017	06
SSP 10/17	Suzlon Energy Ltd, Pune	To validate the corrosion protection scheme of Suzlon S111,120 m hlt WTG and balance of plant	M. Selvaraj	3.45	July 01, 2017	02
GAP 11/17	SERB, New Delhi	Redox flow batteries for renewable energy storage applications	M. Ulaganathan (PI) P. Ragupathy (Mentor)	89.00	June 05, 2017	60
GAP 12/17	SERB, New Delhi	Electrochemical biosensors for the detection of harmful chemicals in the agricultural products.	Noel Nesakumar (PI) Subbiah Alwarappan (Mentor)	19.20	April 10, 2017	24
SSP 13/17	ACT Plast Paints Pvt Ltd	Feasibility studies on hydrogen generation using hydraulic shock process	S. Vengatesan	4.33	August 09, 2017	06
SSP 14/17	Livguard Energy Technologies Private Ltd	Development of next-generation lead-acid batteries for commercial applications	Sundar Mayavan	16.20	August 14, 2017	12

Project No.	Sponsor	Title	Principal Investigator/ Mentor	Contract value (Rs. in lakh.)	Date of start	Duration of the project (in months)
SSP 15/17	VSSC, Thiruvananthapuram	Development of temporary protective coating for maraging steel and 15 CDV6 materials for two years in the marine environment.	M. Selvaraj	14.38	September 01,2017	18
GAP 16/17	DST, New Delhi	Materials and related storage devices for grid deprived communities	N. Kalaiselvi	60.00	August 17, 2017	36
SSP 17/17	VSSC, Thiruvananthapuram	Evaluation of the protective life of Berger black 158 coating on maraging steel (MDN250) and 15CDV6 materials in the marine environment.	D. Sherwood	9.77	September 19, 2017	24
SSP 18/17	A-1 Fence Products Company Limited	Evaluation of painted fencing mesh for corrosion protection	M. Selvaraj	8.26	September 15, 2017	05
GAP 19/17	DST, New Delhi	Metal oxides anchored graphene nanosheets for fabrication of energy storage devices	N. Kalaiselvi	25.05	September 14, 2017	36
GAP 20/17	SERB, New Delhi	Development of electrochemical biosensors for neurotransmitters and clinically important biomolecules	Kesavan Srinivasan (PI) Subbiah Alwarappan (Mentor)	19.20	May 11, 2017	24
GAP 21/17	DST, New Delhi	Wearable screen-printed electrochemical devices for health & environmental monitoring, drug delivery, energy storage and energy harvesting applications.	A. M. Vinu Mohan (PI) J. Mathiyarasu (Mentor)	86.27	April 27, 2017	60
SSP 22/17	Hindalco Industries	Studies on corrosion behaviour of aluminium alloys	G. T. Parthiban	3.60	October 04, 2017	06

Project No.	Sponsor	Title	Principal Investigator/ Mentor	Contract value (Rs. in lakh.)	Date of start	Duration of the project (in months)
GAP 23/17	SERB, New Delhi	Exploring alternative materials for the anode of lithium-ion battery by first-principles calculations	P. Murugan	28.40	October 06, 2017	36
GAP 24/17	SERB, New Delhi	Photolabile nanoprobes for light-induced delivery, imaging, phototherapy, chemotherapeutics and neurogenic disorders	E. S. Shibu (PI) P. Murugan (Mentor)	89.00	October 11, 2017	60
GAP 25/17	SERB, New Delhi	Fabrication of symmet-ric/asymmetric high energy density supercapacitor in non-aqueous electrolytes using bio-derived carbon/carbon nanocomposites	M. Sathish	30.53	October 16, 2017	36
SSP 26/17	Minda Corporati on Ltd.	Control of deposition corrosion on copper cathodes	G. T. Parthiban	4.68	November 10, 2017	06
SSP 27/17	Tata Steel Ltd.	Recovery of metallic tin from tin sludge by electrometallurgical process	L. John Berchmans	25.51	November 06, 2017	24
GAP 28/17	DRDO	Development of one-step electrodeposition of platinum nanoarrays on sulfur-doped graphene for high-performance electrocatalysts	D. Kalpana	13.40	November 15, 2017	12
SSP 29/17	Reliance Indust-ries Ltd	Development of advanced lead-acid batteries using nanomaterials and ionic liquids	Sundar Mayavan	16.21	November 29, 2017	12
SSP 30/17	Boeing Company, USA	Development of corrosion database phase -2 A	S. Mohan	22.57	November 06, 2017	12

Project No.	Sponsor	Title	Principal Investigator/ Mentor	Contract value (Rs. in lakh.)	Date of start	Duration of the project (in months)
GAP 31/17	SERB, New Delhi	Novel graphene reinforced conducting polymer-metal oxide nanocomposites for supercapacitor applications	J. Anandha Raj (PI) M. Sathish (Mentor)	19.20	July 27, 2017	24
GAP 32/17	SERB, New Delhi	Heteroatom doped graphene aerogel/lithiated metal derivative composites for supercapacitor and smart electronics	S. Saravanamoorthy (PI) N. Kalaiselvi (Mentor)	19.20	July 12, 2017	24
SSP 33/17	Boeing Company, USA	Environmentally friendly coatings; chrome-free conductive polymer based wash / etch primer	S. Sathiyanarayanan	16.16	December 01, 2017	18
GAP 34/17	SERB, New Delhi	Development of biopolymer-based Fe_2O_3/hnt nanocomposites for drug delivery applications	G. Vijayaprasath (PI) B. Subramanian (Mentor)	19.20	July 12, 2017	24
GAP 35/17	SERB, New Delhi	A novel approach to design pectin coated ZnO/chitosan/hydroxyapatite biomaterials for cytotoxicity and antibacterial orthopedic implant	S. Ambika (PI) Deepak K. Pattanayak (Mentor)	19.20	August 09, 2017	24
SSP 36/17	Applied Materials India Pvt. Ltd	Electrodeposition of metal and metal oxide	S. Mohan	10.53	December 08, 2017	12
GAP 37/17	DST, New Delhi	Electrochemical immunosensor for handheld rapid detection of dengue virus infection	V. Murugan	97.18	May 17, 2017	48
GAP 38/17	SERB, New Delhi	Nanomaterials as cathodes for utilization of CO_2 into value-added products	P. Manivel (PI) V. Suryanarayanan (Mentor)	19.20	October 03, 2017	24

Project No.	Sponsor	Title	Principal Investigator/ Mentor	Contract value (Rs. in lakh.)	Date of start	Duration of the project (in months)
SSP 39/17	Hindustan Zinc Limited	Design of electro-oxidation reactor for recovery of Na_2SO_4 & NAOH & reduction of COD & chlorides in effluent or RO reject water	A. Manokaran	11.89	December 19, 2017	12
SSP 40/17	Hindustan Zinc Limited	Study on the recovery of manganese as MnO_2 or MN metal from its sulfate stream.	C. Naveen Kumar	9.10	December 27, 2017	09
SSP 41/17	Hindustan Zinc Limited	Removal of graphite from lead-zinc-silver beneficiation process and its conversion to graphene	C. Naveen Kumar	9.98	December 27, 2017	12
SSP 42/17	Hindustan Zinc Limited, Rajasthan	Feasibility study on a) effect of impurities in lead electrolysis, having lead-fluorosilicic acid as the electro-lyte, in terms of (i) cathode quality, (ii) current efficiency, (iii) power consumption. B) a mathematical model for lead electrolysis current efficiency improvement	M. Jayakumar	19.40	December 19, 2017	09
SSP 43/17	DRDL, Hydera-bad	Development of solid film lubricants	G. Subramanian	15.17	January 09, 2018	06
GAP 44/17	SERB, New Delhi	Synthesis and electrochemical characterization of molecular imprinted polymers electrode for biosensor application	A. Thamilselvan (PI) V. Suryanarayanan (Mentor)	19.20	August 07, 2017	24
GAP 45/17	SERB, New Delhi	Development of noble metal-free catalyst for efficient hydrogen evolution from water under visible-light and their practical implementa-tion	R. Rameshbabu (PI) M. Sathish (Mentor)	19.20	October 05, 2017	24
GAP 46/17	SERB, New Delhi	Development of 2D Ti_3C_2 mxene nanosheets based hybrid nanostructures and aerogels for electrocatalytic and energy storage applications	K. V. Mahesh (PI) Subbiah Alwarappan (Mentor)	19.20	October 23, 2017	24

Project No.	Sponsor	Title	Principal Investigator/ Mentor	Contract value (Rs. in lakh.)	Date of start	Duration of the project (in months)
GAP 47/17	Defence Laboratory	Feasibility studies for the electrodeposition of aluminium on ultrafine lightweight fibers	N. Rajasekaran	9.93	February 05, 2018	18
SSP 48/17	Bimetal Bearings Ltd., Coimbatore	Development of polymer coatings for bearing applications.	N. Rajasekaran	9.43	January 29, 2018	09
GAP 49/17	SERB, New Delhi	Vertically grown and randomly aligned one-dimensional (1D) TiO_2 and ZnO nanowires decorated with $BiVO_4$, a-Fe_2O_3, and WO_3 for photo-electrochemical and dye-sensitized solar cells	P. Soundarrajan (PI) S. M. Senthil Kumar (Mentor)	14.40	October 05, 2017	24
SSP 50/17	NTPC Tamil Nadu Energy Company Ltd., Chennai	Corrosion survey of concrete structures, pipelines, steel structures, survey and recommendation of appropriate corrosion protection system(s).	V. Saraswathy	21.55	March 01, 2018	06
SSP 51/17	Vedanta Limited, Thoothukudi	Condition assessment of various structural components with respect to corrosion at Sterlite copper plant and suggestion of suitable protective schemes to concrete and steel structures.	K. Saravanan	28.91	March 09, 2018	06
SSP 52/17	LG Balakrishnan and Bros Ltd., Coimbatore	Sputter coating of chromium nitride (CRN) onto automotive chain pins	B. Subramanian	17.56	March 14, 2018	06

Project No.	Sponsor	Title	Principal Investigator/ Mentor	Contract value (Rs. in lakh.)	Date of start	Duration of the project (in months)
GAP 53/17	Indo-US Science and Technology Forum	Light-induced energy technologies: Utilizing promising 2D nanomaterials (lite up 2D)	Vijayamohanan K. Pillai	39.36	March 26, 2018	24

2. CONSULTANCY PROJECTS

Project No.	Client	Title	Principal Investigator	Value of Contract (Rs. in	Date of Start	Duration (in months)
CNP 01/17	Tata Chemicals Ltd.	Advisory consultancy on a corrosion survey of plant assets of Tata Chemicals at Mithapur and submission of a report with suitable coating schemes to Enhance the Life of the Plant Structures	M. Selvaraj	6.90	April 25, 2017	06
CNP 02/17	NLC Tamil Nadu Power Ltd.	The suggestion of a suitable protective coating system for concrete and steel structures with and without cathodic protection (cp) for the NLC Tamilnadu Power Corporation (NTPL), Tuticorin	M. Selvaraj	4.60	June 30, 2017	06

Project No.	Client	Title	Principal Investigator	Value of Contract (Rs. in Lakh)	Date of Start	Duration (in months)
CNP 03/17	Sumitomo Electric Industries Ltd., Haryana	Interference study on cathodically protected underground pipelines due to HVDC Line	SP. Manoharan	13.50	February 16, 2018	03
CNP 04/17	P. Meeraza, Tuticorin	Testing of epoxy coating systems and inspection of paintings work in NCTPC at Chennai.	M. Selvaraj	3.54	February 23, 2018	06
CNP 05/17	Tamil Nadu Zari Ltd., Kancheepuram	Advice for gold plating on Ag thread	S. Mohan	1.77	February 22, 2018	06

3. TECHNICAL SERVICE

Project No.	Client	Title	Principal Investigator	Value of Contract (Rs. in Lakh)	Date of start	Duration of the project (in months
TSP 01/17	Gowell Industries	Testing of 12 V / 150 Ah tubular type lead-acid battery	P. Seenichamy	1.55	May 04, 2017	03
TSP 02/17	Maruti Suzuki India Ltd.	Industrial practices on electroplating	S. Mohan	1.31	January 28, 2017	06
TSP 03/17	Perundurai Common Effluent Treatment Plant	Evaluation of electrochemical reactor at Perundurai common treatment plant using a dye bath	B. Ramesh Babu	0.60	May 30, 2017	02
TSP 04/17	Exide Industries Ltd.	Morphological analysis and characterization of lead-acid battery plates	Sundar Mayavan	2.07	May 17, 2017	12
TSP 05/17	UL India Pvt Ltd.	Training on batteries with emphasis on Li-ion battery	S. Gopukumar	5.18	June 27, 2017	06
TSP 06/17	LG. Balakrishnan and Bros. Ltd.	Testing of automotive chain pins	B. Subramanian	1.07	June 28, 2017	02
TSP 07/17	Blue Dart Aviation Ltd.	Evaluation of Li-ion Cells	S. Gopukumar	3.15	August 21, 2017	03
TSP 08/17	Anil Singh	Endurance test for 75 Ah battery as per IS 13369: 1992 specification	Sundar Mayavan	1.45	August 28, 2017	06

Project No.	Client	Title	Principal Investigator	Value of Contract (Rs. in Lakh)	Date of start	Duration of the project (in months
TSP 09/17	Tata Steel Ltd.	Testing and characterization of different rebar samples and their passivation properties	L. John Berchmans	10.93	September 01, 2017	08
TSP 10/17	Aqua Works Private Ltd.	Surface analysis of impregnated carbon samples using X-Ray Spectroscopy	J. Kennedy	2.91	October 10, 2017	03
TSP 11/17	Indus Towers Ltd.	Lead acid battery testing as per IS 15549 specification	P. Seenichamy	10.95	November 23, 2017	12
TSP 12/17	Mysore Thermo Electric Pvt. Ltd.	Battery testing 2V/500 Ah LMLA cells in PPCP as per IRS :S: 88/2004	V. Muthumani	5.59	January 19, 2018	24
TSP 13/17	S. Prince High Tech Pvt. Ltd.	Testing of the coating system	M. Selvaraj	1.18	January 01, 2018	02
TSP 14/17	Lam Research India Pvt. Ltd.	Training program on electroplating	S. Mohan	3.78	January 10, 2018	06
TSP 15/17	Wipro Enterprises (P) Bengaluru	3D printing of metals	S. Mohan	2.90	January 01, 2018	12

4. INTELLECTUAL PROPERTY LICENSED

No.	Title	Licensee	Licensed through CSIR/NRDC/ Others	Terms of License	Effective Date of Licence/Renewal
1	Inhibitor solution	Trishul Industries, Jodhpur	CSIR	L.S: Rs.300000/- +18%S.T RR: 2.5% , PL: 5 years, NL: N.E	May 30, 2017
2	Mixed metal oxide electrode coating technology for anodes of electrochemical cells	IEC Fabchem Ltd., Chennai, Tamil Nadu	CSIR	L.S: Rs.600000/- +18%S.T RR: 2.5% , PL: 5 years, NL: N.E	December 13, 2017
3	Corrosion resistant inhibitive admixture for portland pozzolana cement	Clean-Flo India Pvt. Ltd., Delhi	CSIR	L.S: Rs.500000/- +18%S.T RR: 2.5% , PL: 5 years, NL: N.E	December 26, 2017
4	CPCC	Protektol Anti-corrosives, Chennai	CSIR	L.S: Rs./1500000- +18%S.T RR: 2.5% , PL: 7 years, NL: N.E	January 08, 2017

*LS – Lumpsum premium; RR – Recurring royalty; PL – Period of licence; NL – Nature of licence; N.E. – Non-exclusive.

5. MEMORANDUM OF UNDERSTANDING (MOU) SIGNED WITH INDUSTRIES/INSTITUTIONS

Sl.	Date	Name of the industry/institution	Title
1	April 20, 2017	Deakin University, Australia	International research collaboration
2	May 22, 2017	Trishul Industries, Jodhpur	Inhibitor solution
3	June 06, 2017	Auroma Clean Energy India Pvt. Ltd., Hyderabad	Scaling up of manufacturing of 18650, prismatic and pouch indigenous lithium ion and related energy cells for multifarious applications
4	July 07, 2017	Tata Steel Ltd., Jamshedpur	Recovery of metallic tin from tin sludge by electrometallurgical process
5	August 19, 2017	Lycan Lab, a unit of Lycan Printing Solutions Pvt. Ltd., Bengaluru	Metal additives
6	September 15, 2017	Reliance Industries Ltd., Mumbai	Electrochemical conversion of CO_2 to formaldehyde
7	October 03, 2017	Aqua Works Pvt. Ltd., Bengaluru	Surface analysis of impregnated carbon samples using X-ray spectroscopy
8	November 01, 2017	Hindustan Zinc Ltd., Udaipur	Contract research programmers in the interest of reinforcing each others' desire to achieve technological excellence by working together in the form of sponsored
9	November 17, 2017	Reliance Industries Ltd., Mumbai	Development and validation of 1kWe open cathode Lt-PEMFC stack
10	December 08, 2017	IEC Fabchem Ltd., Chennai	Mixed metal oxide electrode coating technology for anodes of electrochemical cells
11	March 14, 2018	Enerrsto Solutions Pvt. Ltd., Chennai	Manufacturing / supplying of lithium-ion cells for solar lantern applications

SEMINAR AND TRAINING [S&T]

1. DEPUTATION TO CONFERENCES/SEMINARS/WORKSHOPS

	PROGRAMME	VENUE AND DATE
1	International conference on Sustainable environment and energy [ICSEE' 17]	Hindustan University, Rajiv Gandhi Salai, [OMR], Pudur, Kelambakkam, Chennai. April 06-07, 2017
	Staff deputed: Paranapalle Ravi, Suresh Balaji	
2	Corrosion Awareness Day [CAD 2017]	St. Mary's College [Autonomous], Thoothukudi. April 06, 2017
	Staff deputed: G. T. Parthiban, S. Maruthamuthu, S. Sathiyanarayanan, SP. Manoharan, K. Saravanan, S. Muralidharan	
3	Effective Implementation of RTI and Record Management	CSIR-HRDC, Ghaziabad. April 06-07, 2017
	Staff deputed: S. M. Rajendran	
4	Smart Materials: Methods and Applications [SMMA-2017]	Indian Institute of Science Education & Research [IISER] Kolkatta, Mohanpur, West Bengal. April 20-22, 2017
	Staff deputed: Deepak Kumar Pattanayak	
5	National Seminar on Emerging & Re-Emerging Infectious Diseases	Central University of Tamil Nadu, Kangalancherry-Post, Thiruvarur. April 21, 2017
	Staff deputed: R. Venkatesh	
6	Workshop on Advanced Functional Materials [FUNMAT-2017]	CSIR-CECRI, Karaikudi. May 22, 2017
	Staff deputed: James Joseph, J. Mathiyarasu, C. Sivakumar, A. Palaniappan, V. Ganesh, S. Senthilkumar, C. Suresh, M. Murugesan, S. Radhakrishnan, A. M. Vinu Mohan, V. Manju, S. V. Sheen Mers, R. Rajaram, T. Balamurugan, C. Venkateswararaju, K. Silambarasan, G. Kalaiyarasan, P. Kanagavalli, P. Suganya, A. Sivakumar, A. Venkatesh, B. Subramanian, S. T. Nishanthi, K. S. Abisegapriyan, V. Suryanarayanan, M. Vijayan, Sailaja Krishnamurthy, P. Murugan, M. Sathish, A. Pandikumar, C. Praveen, Ramesh Mohan, N. Prakrithi, N. Prabhu, P. Ananthaganesh, P. Thangasamy, K. Subramani, M. Karnan, Suresh Balaji, P. Ravi, Abbasriyaludeen, K. Santhosh, Seethalakshmi, J. Kamarasmam, Aman Tripathi, J. Karthikeyan, S. Kumaraguru, S. Jeevanantham, KashiJoshi, Mohammed Azeezulla, R. Thangamuthu, M. Selvaraj, G. Murugadas, ShailendraJha, Subhendu K Panda, Deepakkumar Pattanayak, P. Seenichamy, V. Muthumani, V. Sekar, S. Mithinkumar, S. Arun, S. Anitha, C. Arul,S. Arunkumar, S. Saravanakumar, MG. Neelavannan, N. Lakshminarasimhan, G. Anantharaj, Raju Thota, Akiode Olubunmi Kolawole	
	Staff deputed: R. Venkat Karthick	
7	Workshop on Theory and Practice of X-ray Diffraction Techniques [TPXROT-2017]	Alagappa Chettiar College of Engineering and Technology, Karaikudi. May 25-27, 2017
	Staff deputed: R. Venkat Karthick	
8	CSIR Leadership Development Programme	CSIR-NIO, Goa.May 29 - June 02, 2017
	Staff deputed: N. Lakshminarasimhan, V. Ganesh, Santoshkumar D. Bhat	

	PROGRAMME	VENUE AND DATE
9	Joint 16th International Symposium on Trace Elements in Man and Animals [TEMA-16], ISTERH 2017 and NTES 2017 Meetings	St. Petersburg Hotel, St. Petersburg, Russia. June 26-29, 2017
10	International conference on Frontier Areas in Chemical Technologies-2017 [FACTS-2017]	Dept. of Industrial Chemistry, Alagappa University, Karaikudi. July 06-08, 2017
	Staff deputed: S. Gopi, M. Kanagaraj, M. Kathiresan, S. Indirajith, K. Selvakumar, R. Thangamuthu, S. M. Senthilkumar, G. Murugadoss, K. Kulangiappar, V. Suryanarayanan, V. Rajagopal, T. Prem Kumar, V. M. Shanmugam	
11	21st CRSI National Symposium in Chemistry & CRSI-ACS Symposium in Chemistry	CSIR-IICT, Hyderabad. July 13-16, 2017
	Staff deputed: A. Subbiah, M. Kathiresan, S. Gopi, M. Kanagaraj	
12	International conference of Electron Microscopy & Allied Techniques & XXXVIII Annual Meeting of the Electron Microscope Society of India EMSI-2017	Chennai. July 17-19, 2017
	Staff deputed: M. Sathish	
13	Programme on 34th Induction Training Programme for the Newly Recruited Scientists	CSIR-HRDC, Ghaziabad. July 17-26, 2017
	Staff deputed: V. Saranyan, SP. Thipperudraswamy, Sindhu Nambiar	
14	One Day National Level Seminar on Regulatory Compliance Handling in Industries towards pollution control	Fortune Hotel, Chennai. August 04, 2017
	Staff deputed: A. Manokaran	
15	International Conference on Crystal Ball Vision on Science & Engineering for Societal Upliftment	CSIR-NIO, Goa. August 07-08, 2017
	Staff deputed: M. Sathish, P. Murugan	
16	Fourth International Conference on Nanoscience & Technology [ICONN-2017]	SRM University, Kattankulathur, Chennai. August 09-11, 2017
	Staff deputed: S. Arunkumar, C. Anitha	
17	Second International Conference on Electrochemical Science and Technology [ICONEST-2017]	IISc, Bengaluru. August 10-12, 2017
	Staff deputed: S. Senthilkumar, P. Kanagavalli, P. Suganya, S. V. Seen Mers, S. Shruti, Roselin Ansila, Gopi, Indirajith, M. Jayakumar, V. Rajagopal, N. Venkatesan, M. Sathishkumar	

	PROGRAMME	VENUE AND DATE
18	One Day Training Programme on Basic Fire Safety and CPR Techniques	Breeze Residency, Trichy. August 29, 2017
	Staff deputed: P. Ravi, J. Anantha Raj, J. Kamarsamam	
19	First World Conference on Solid Electrolytes for Advanced Applications: Garnets and Competitors	Pondicherry University, Pudhucherry. September 06-09, 2017.
	Staff deputed: M. Sathish, N. Prabu, A. N. Prakrthi, P. Anandhaganesh	
20	6th Asian Biomaterials Congress: ABMC6	Apollo DIMORA, Thiruvananthapuram. October 25-27, 2017
	Staff deputed: Deepak K. Pattanayak, Archana Rajendran, B. Subramanian, S. T. Nishanthi, S. Thangarajan, K. S. Abisegapriyan, V. V. Anusha Thampi, J. Nivedhitha	
21	Kalam Young Researchers Conference on Mechanistic Insights into Electrochemical Processes [KYRC-2017]	CSIR-CECRI, Karaikudi. October 16, 2017
	Staff deputed: N. Kalaiselvi, M. Ulaganathan, S. Saravanamoorthy, K. Balakumar, P. Remith, V. Mani, KR. Saravanan, V. Mullaivananathan, G. N. Suresh Babu, M. Nagalakshmi, A. Venkadesh, N. Lakshminarasimhan, A. Pandikumar, P. Murugan, M. Sathish, J. Karthikeyan, G. Anantharaj, Krati Joshi, Mohammed Azzezula, N. Prabu, A. N. Prakrthi, K. Subramani, P. Thangasamy, P. Anandha Ganesh, A. Abbasriyalideen, Parpalle Ravi, S. Seethalakshmi, S. Suresh Balaji, J. Kamarsamam, Aman Tripathi, K. Nagaraj, Akiode Olubunmi Kolawole, B. Subramanian, K. S. Abisegapriyan, V. V. Anusha Thampi, S. Hosimin, S. Manikandan, C. Karthikeyan, S. Rajeswari	
22	Training of Trainer & Assessors, General Industrial (Liquid) Painter (PCS/Q5108)	Chennai. October 23-25, 2017
	Staff deputed: K. Muthuraman, R. Jeyaram	
23	International Conference on Thin Films [ICTF-2017]	CSIR-NPL, New Delhi. November 13-17, 2017
	Staff deputed: P. Krishnaveni	
24	All India Conference on Challenges in Domestic and International Arbitration	Hotel Toshall Sands, Puri. November 16-18, 2017
	Staff deputed: C. Christu Raj	

	PROGRAMME	VENUE AND DATE
25	Training of Trainer & Assessors Protective and Marine Painter (PCS/Q5109)	CSIR-CECRI, Karaikudi. November 20-25, 2017
	Staff deputed: S. Muralidharan, A. Madhavamayandi, K. Arumugasamy, M. S. Karthikeyan, K. Murhturaman, R. Jeyaram, A. Gopalakrishnan, T. Siva, T. Bharathidasan, Viji, N. Ramakrishnan, R. Monika, Rakesh C. Barik, Poonam Singh	
26	Two-day training programme on High-Resolution Transmission Electron Microscopy, Scanning Electron Microscopy & Scanning Probe Microscopy	PSG College of Technology, Coimbatore. November 23-24, 2017
	Staff deputed: M. Karnan, P. Ravi, P. Ananthaganesh	
27	JNCASR-12 CAM School on Clean and Renewable Energy Technologies via Chemical Route	JNCASR, Bengaluru. November 27 - December 02, 2017
	Staff deputed: A. Pandikumar	
28	Programme on Creativity and Innovation for Rural Societies	CSIR-HRDC, Ghaziabad. December 04-06, 2017
	Staff deputed: K. Saravanan	
29	International Symposium on Nanomaterials for Clean and Health Applications	Coimbatore Institute of Technology, Coimbatore. December 06-08, 2017
	Staff deputed: N. Prabu, R. Kalidoss	
30	Conference on Bengaluru INDIA NANO 2017	The Lalith Ashok, Bengaluru. December 07-08, 2017
	Staff deputed: S. Kesavan	
31	International Conference on Molecular Spectroscopy-ICMS-2017	Mahatma Gandhi University, Kottayam. December 08-10, 2017
	Staff deputed: S. Surti, Roselin Ansilda	
32	International Conference on Advanced Materials for Energy	Madurai Kamaraj University, Madurai. December 11-12, 2017
	Staff deputed: Abbasriyaludeen, S. Suresh Balaji	

	PROGRAMME	VENUE AND DATE
33	International Conferenc on Advanced Materials and Process (ADMAT 2017)	Thiruvananthapuram. December 14-16, 2017
	Staff deputed: Rakesh C. Barik, G. Sreedhar	
34	National Conference on Challenges in Electrochemical Energy Storage and Conversion Systems-Battery-2017	Kongunadu Arts and Science College, Coimbatore. December 15-16, 2017
	Staff deputed: N. Venkatesan, R. Aswathy, J. Anandharaj	
35	ECS-India School on Applications of Functional Materials for Electrochemical Energy Conversion by Prof V. Kamat, University of Notre Dame, USA	Amrita Vishwa Vidyapeetham University, Coimbatore. December 26-28, 2017
	Staff deputed: M. Sathish, A. Pandikumar, P. Thangasamy, K. Subramani, P. Anandha Ganesh, M. Karnan, Parnapalle Ravi, J. Kamarsamam, Aman Tripathi, N. Prabu, J. Anandha Raj, G. Anantharaj, Krati Joshi, Abbasriyalideen, S. Seethalakshmi, K. Chitra, B. Subramanian, M. Kathiresan, K. Giribabu, S. Gopi, P. Murugan, J. Karthikeyan, P. Ragupathy, M. Jayakumar, S. Radhakrishnan, N. Kalaiselvi, V. Mani, V. Mullaivananathan, A. M. Vinu Mohan, V. Rival Jose, M. Anbu Kulandainathan, Akiode Olubunmi Kolawole, James Joseph, J. Mathiyarasu, C. Sivakumar, A. Palaniappan, S. Senthilkumar, C. Suresh, S. Vasudevan, S. Venkatesan	
36	International Conference on Advanced Materials for Technological Application (ICAM 18)	PSGR Krishnammal College for Women, Coimbatore. January 03-05, 2018
	Staff deputed: C. Anitha	
37	Indo-US Bilateral Workshop on Nanotechnology for Clean Energy Generation and Storage	PSG Tech., Coimbatore. January 10-12, 2018
	Staff deputed: G. N. Suresh Babu, V. Mani	
38	Induction Training Programme for newly recruited Scientists	CSIR-HRDC, Ghaziabad. January 15-24, 2018
	Staff deputed: M. Jayakumar, V. Ravibabu	
39	National Conference on Contribution of SC/ST Scientists and Technologists towards Advancement of Science and Engineering [NCSCSTASE-2018]	CSIR-NAL, Bengaluru. January 23-25, 2018
	Staff deputed: S. M. Rajendran, K. Radhakrishnan, G. Sreedhar, P. Seenichamy, M. Balakrishnan	
40	Workshop on Principle and Application of Electron Para-magnetic Resonance Spectroscopy	NIT, Goa. January 29 – February 09, 2018
	Staff deputed: V. M. Shanmugam	

	PROGRAMME	VENUE AND DATE
41	Workshop on Metal Finishing Technologies on Electroplating-2018	IISc, Bengaluru. February 01-02, 2018.
	Staff deputed: R. S. Prasannakumar	
42	National Conference on Recent Trends in Chemistry	RMVC, Coimbatore. February 02, 2018
	Staff deputed: A. Tamilselvan	
43	Conference on Indian Analytical Science Congress 2018	Mahatma Gandhi University, Kottayam. February 08-10, 2018
	Staff deputed: N. Dharuman, M. Suresh Kumar, U. Mehana, M. Kuralarasan	
44	5th International Conference on Nanomaterials of Nanocomposites	VIT, Chennai. February 08-10, 2018
	Staff deputed: A. Tamilselvan	
45	National Symposium on Advances in Functional and Exotic Materials and 29th Annual GM of MRSI	Bharathidasan University, Tiruchirappalli. February 14-16, 2018
	Staff deputed: B. Subramanian, M. Sathish	
46	19th National Seminar of ISSG Workshop on Advanced Scientific Glass Blowing Techniques for Science and Technology and seminar on The Role of Scientific Glass Blowing for R&D	Osmania University, Hyderabad. February 15-18, 2018
	Staff deputed: A. Arumugam	
47	Conference on Electrochemistry in Advanced Materials, Corrosion and Radiopharmaceuticals (CEAMCR-2018)	DAE Convention Centre, BARC, Mumbai. February 15-18, 2018
	Staff deputed: P. Amrutha, S. Senthilkumar	
48	International Symposium on Eco-Materials Processing & Design	Jaipur. February 19, 2018
	Staff deputed: M. Praveen Kumar	
49	Programme in Technical consulting for scientists and technical officers in association with CDC, New Delhi	CSIR-HRDC, Ghaziabad. February 20-23, 2018
	Staff deputed: P. Venkatesan	

	PROGRAMME	VENUE AND DATE
50	International Conference on Powder Metallurgy and Particulate Materials-PM18	CIDCO Exhibition Centre, Navi Mumbai. February 21-23, 2018.
	Staff deputed: Deepak K. Pattanayak	
51	28th National Symposium on Electrochemical and Chemical Technology-INTERSECT-2K18 Conference	CSIR-CECRI, Karaikudi. February 21-23, 2018
	Staff deputed: T. Balamurugan, N. Ramakrishnan, A. Abbasriyaludeen, P. Anandha Ganesh, Indherjith, N. Venkatesh, V. Prasanth, S. Sudhakar, A. Venkatesh, N. Venkatesan, K. Shankar, V. Rajagopal, K.S. Abisegapriyan, J. Premkumar, T. Manikandan, R. Vinoth, M. Karan, S. Karthikeyan, V. Ravijose, S. Sathya, Balakumar, V. Mani, KR. Saravanan, V. Mullaivananthan, G. N. Suresh Babu, M. Nagalakshmi, Packiyalakshmi, M. Ulaganathan, S. Saravanamoorthy, K. S. Neethu, M. Suresh Kumar, M. Dhanuraman, M. Kuralarasan, U. Mehana	
52	National Conference on Recent Advanced Materials (NCRAM 2018)	Thiruvalluvar University College of Arts and Science, Vandavasi. February 23-24, 2018.
	Staff deputed: V. Murugan, P. Kanagavalli, P. Gaurav, L. Mariya Salomi	
53	One day workshop on A technology Know-how Platform on the Indigenous Development of Superconductors for Naval Applications	VIT, Chennai. February 24, 2018
	Staff deputed: M. Karnan, K. Subramani	
54	National Conference on Recent Advances on Materials for Sustainable Energy (RAMSE-2018)	IIT (ISM) Dhanbad. March 02-04, 2018
	Staff deputed: Shailendra K. Jha, P. Sriram	
55	Workshop on Battery Technology and Electric Mobility	HPCL, Bengaluru. March 08-09, 2018
	Staff deputed: S. Gopukumar, P. Ragupathy, K. Selvakumar	
56	Workshop on Nano-Bio-Sensors: Present Status and Future Perspectives NANOSE-2018	Alagappa University, Karaikudi. March 08-09, 2018
	Staff deputed: P. Manivel	
57	International Conference on Recent Trends in Analytical Chemistry (ICORTAC-2018)	University of Madras, Guindy Campus. Chennai. March 15-17, 2018
	Staff deputed: C. Venkateswara Raju, G. N. Suresh Babu	

	PROGRAMME	VENUE AND DATE
58	105th Indian Science Congress	Manipur University, Imphal, Manipur. March 16-20, 2018
	Staff deputed: J. Kennedy	
59	Customized Training Module for Parliamentary Procedure	LIGHTS Research Foundation, New Delhi. March 20-23, 2018.
	Staff deputed: C. Christuraj	
60	International Conference on Nanoscience and Technology (ICONSAT)	IISc, Bengaluru. March 21-23, 2018
	Staff deputed: P. Manivel	
61	MATLAB-'18 workshop	Alagappa University, Karaikudi. March 26-27, 2018
	Staff deputed: K. Selvakumar, S. Indherjith	

2. Short-term Refresher Courses / Training

A) INDUSTRY-ORIENTED TECHNOLOGY / REFRESHER COURSES

CSIR-CECRI offers a variety of courses to scientific and technical personnel in industries, government, and academic institutions. These moderately charged courses are designed to impart the necessary knowledge and skills and are conducted by talented and highly competent scientists and technical staff. Participants are given ample opportunities to have hands-on experience.

During 2017-'18, CSIR-CECRI conducted 6 Industry-oriented technology/Refresher courses. The duration of each course was 5 days. During 2017-'18, 129 participants attended from various organizations.

Sl. No.	Name of the course	Area code	Duration (5 days)	No. of participants
1	Cathodic Protection and Pipeline Corrosion	CSE-1	August 28 – September 01, 2017	45
2	Paints for Corrosion Protection	CSE-2	September 18-22, 2017	25
3	Electrochemical Power Sources - Li-ion Battery	ECPS-2	November 13-17, 2017	22
4	Electroplating and Anodizing - Principles and Practices	EMFT-1	November 27 – December 01, 2017	23
5	Waste Water Treatment Technologies	EPC-1	December 04-08, 2017	10
6	Nanostructured Coatings	ECMS-1	December 18-22, 2017	08



Refresher course on Cathodic Protection and Pipeline Corrosion (CSE-1), (August 28 - September 01, 2017)



Refresher course on Electrochemical Power Sources-Li-ion Battery (ECPS-2) (November 13-17, 2017)



Refresher course on Waste Water Treatment Technologies (EPC-1), (December 04-08, 2017)

B) TAILOR-MADE TRAINING PROGRAMME

To suit the needs of the industrial client, the following special tailor made training programme were conducted

Name of the programme	Client	Venue	Duration	No. of partici-pants	Amount (Rs. in Lakh)
Batteries with special emphasis on Li-ion batteries	UL India Pvt. Ltd, Bengaluru	Bengaluru	July 05-07, 2017	32	5.18
Li-ion batteries and PEM fuel cell	TVS Motor Company Ltd., Hosur	CSIR-CECRI Chennai Unit	November 21, 2017	21	2.18
Electroplating	LAM Research India Ltd., Bengaluru	CSIR-CECRI	January 22-24, 2018	12	4.13
Total	65			65	11.49





Tailor-made training programme on batteries with special emphasis on Li-ion batteries for UL India Pvt. Ltd., Bengaluru (July 05-07, 2017)



Tailor-made training programme on Li-ion batteries and PEM fuel cell for TVS Motor Company, Hosur, (November 21, 2017)

CSIR-CECRI'S SKILL DEVELOPMENT TRAINING PROGRAMMES

Objectives

The objectives of CSIR's integrated skill initiative programme are to link the economic development with human resource and to create employment opportunities with relevance to prevailing and emerging industrial requirements. It also aims at the development of a large number of Indian youth through training and providing hands-on experience with experiments in diverse areas to promote entrepreneurship that will help them in securing a better livelihood. Under this initiative, CSIR-CECRI has designed and conducted various skill development training programmes in two different levels:

Level – 1: One-month training programme for those who completed Secondary (10th Std.) or Higher Secondary (12th Std.) Education or ITI (Pass/Fail). The medium of instruction is Tamil.

Level – 2: One-month training programme for those who completed any degree/diploma (with Chemistry as one of the subjects). The medium of instruction is English.

1. Lead-acid Battery Care and Maintenance (LAB)

The training programme on lead-acid battery care and maintenance was conducted in three batches.

Sl. No.	Name of the training	Duration	Venue	No. of partici-pants
1	Lead-acid Battery - Care and Maintenance	30 days March 21, 2017 –April 20 2017	CSIR-CECRI	22
2	Lead-acid Battery - Science & Technology - Care and Maintenance	23 days June 05-30, 2017	CSIR-CECRI	75
3	Lead-acid Battery - Care and Maintenance	22 days December 06-27, 2017	Rural Training Centre (RTC), Amaravathipudur	18



Demo on battery assembling and valedictory function of training programme on lead-acid battery – care and maintenance (March 21, 2017 – April 20 2017)

2. Electroplating and Metal Finishing

The skill development training programme on electroplating and metal finishing was conducted at KLN College of Engineering, Pottapalayam, Sivagangai District and CSIR-CECRI, Karaikudi during April 06 - May 05, 2017. The programme was inaugurated by Er. K. N. K. Karthik, President, KLNCE, Pottapalayam on April 06, 2017, Dr. Vijayamohanan K. Pillai, Director, CSIR-CECRI presided the function, Dr. K. N. K. Ganesh, Secretary, KLNCE, Pottapalayam and Dr. T. Mukundan, Chief Scientist, Naval Physical and Oceanographic Laboratory (NPOL), Cochin were present as Guest of Honour. In the training programme, 27 people, most of them were from Electroplaters Units, Madurai, had been trained.

3. Paints and Coatings for Corrosion Protection (PCCP)

The following programmes were conducted in paints and coatings:

3.1. Training Programme on Paints and Coatings

The training programme on paints and coatings for prevention of corrosion and biofouling on the sea-going vessels was conducted at CSIR-CECRI Corrosion Testing Centre, Mandapam during May 15-30, 2017, for the benefit of 30 fishermen in and around Mandapam and Rameswaram during the fishing ban period.

3.2. Training Programme on Protective and Marine Painter

A one-month certificate programme on protective and marine painter was organized at CSIR-CECRI Mandapam Unit during May 30 - June 29, 2017 for the benefit of 33 unemployed youth in and around Rameshwaram. The programme was inaugurated on May 30, 2017 with inaugural address by Shri S. Natarajan, IAS, Collector, Ramanathapuram District and presidential address by Dr. Vijayamohanan K. Pillai, Director, CSIR-CECRI.



The inaugurational and valedictory function of skill development training programme on electroplating and metal finishing (April 06 - May 05, 2017)



Shri. G. Shanmuganathan, Addl. Industrial Advisor, MSME-DI, Chennai delivering the inaugural address on the training programme in paints and coatings for fishermen on (May 15-30, 2017)



Hands on skill training for fishermen on paints and coatings



Shri S. Natarajan, IAS, Collector, Ramanathapuram District, delivering the inaugural address during the training programme on protective and marine painter on May 30, 2017



Dr. Vijayamohanan K Pillai, Director, CSIR-CECRI delivering the presidential address during the training programme on protective and marine painter on May 30, 2017



Demo and hands-on experimental training during the skill development programme on the Protective and Marine Painter (May 30 - June 29, 2017)

3.3. Paints and Coatings for Corrosion Protection

To develop a technical skill for unemployed rural youth with diploma/degree having average/poor academic performance and to create employment opportunities, a skill development certificate programme in paints and coatings for corrosion protection was conducted by CSIR-CECRI at Rural Training Centre, Amaravathipudur during December 06-27, 2017. Through this training programme, 23 unemployed rural youth had been benefited.

4. Waste Water Treatment Technologies for Textile and Tannery Industries, and Operation and Maintenance of Analytical Instruments

The training programmes on waste water treatment technologies for textile and tannery industries, and operation and maintenance of analytical instruments were held at CSIR-CECRI, Karaikudi during November 21 - December 05, 2017. A total of 44 participants (24+20) were trained in these programmes. The programmes were inaugurated by Shri. V. S. Ram, CEO, Paints and Coatings Skill Council, Mumbai, and Dr. Vijayamohanan K. Pillai, Director, CSIR-CECRI presided the function. Dr. S. Jeyashree, Principal, Dr Umayal Ramanathan College for Women (URCW), Karaikudi and Mrs. Alamelu, Director, Rural Training Centre (RTC), Amaravathiputhur were the special guests. Prof. H. S. Sarkar, Calcutta Institute of Technology, Kolkata made the valedictory remarks and Dr. D. Velayutham, Chief Scientist, CSIR-CECRI presided the valedictory function. Shri. Narayana Sharma, Managing Director, Accurion Scientific Instruments Pvt. Ltd., Bengaluru delivered the valedictory address for operation and maintenance of analytical instruments training



The inauguration of two skill development programmes on Lead-acid Battery and, Paint and Coatings at Rural Training Centre (RTC), Amaravathiputhur (December 06-27, 2017)

programme. Shri. K. Ramesh, Senior Manager, Process Engineering, Tamil Nadu Water Investment Company Ltd., Tiruppur delivered the valedictory address for wastewater treatment technologies for textile and tanner industries programme.

5. JIGYASA Programme

5.1. Science Competitions

JIGYASA, a student-scientist connect programme launched by Council of Scientific and Industrial Research (CSIR) and Kendriya Vidyalaya Sangathan (KVS), to make science awareness and to inculcate the culture and scientific temper amongst the school students and teachers of KVS. CSIR-CECRI conducted various science competitions viz., drawing, essay writing, elocution, quiz, and prototype model making to the students of KVS on September 17, 2017. A total of 90 students from various KVs in the southern part of Tamil Nadu participated in the programme. The winners of these competitions were distributed with prizes and certificates during the CSIR Foundation Day celebrations held on September 25, 2017 at CSIR-CECRI, Karaikudi where Prof. Satishchandra B. Ogale, Department of Physics and Centre for Energy Science, Indian Institute of Science Education and Research (IISER), Pune was participated as chief guest.



Prototype model making

5.2. Science Exhibition by Kendriya Vidyalaya Students on CSIR-CECRI Open Day

A science exhibition was conducted by Kendriya Vidyalaya Students on the occasion of CSIR-CECRI open day observed on September 26, 2017 at CSIR-CECRI, Karaikudi. During the programme, 12 students from various KVs participated and exhibited their models and prototypes.

6. Motivation Training Programme

In order to promote interest, excitement, excellence in science education and learning capabilities of students to take up science as a career, a four-day motivation training programme for KV students of IX-XII standards was conducted during January 09-12, 2018 at CSIR-CECRI, Karaikudi. In this programme, 118 students and 14 teachers participated from 11 Kendriya Vidyalaya Sangathan. The programme was inaugurated by Shri R. Senthilkumar, Assistant Commissioner, Kendriya Vidyalaya Sangathan, Chennai and Dr. Vijayamohanan K. Pillai, Director, CSIR-CECRI presided the function. Dr. P. Sivakumar, Dean, Faculty of Education, Alagappa University, Karaikudi was present as Guest of Honour. Shri. N. Sivakumar, Principal, Chellappan Vidya Mandir, Karaikudi, delivered veledictory address. Dr. D. Velayutham, Chief Scientist, CSIR-CECRI presided the function.



Science Exhibition on open day



Dr. Vijayamohanan K. Pillai, Director, CSIR-CECRI addressing the participants during the inauguration of Motivation Training

SOPHISTICATED ANALYTICAL INSTRUMENT FACILITY (SAIF)

Instrumental methods of analyses form an indispensable aspect of any R & D programme. Sophisticated Analytical Instrument Facility (SAIF), formerly known as the Central Instrumentation Facility (CIF), was established at CSIR-Central Electrochemical Research Institute, Karaikudi, in the year 2004, with an objective of providing all analytical facilities under one roof in order to enable our scientific community to carry out analysis for their R&D work in various scientific disciplines and is being maintained by a team of dedicated scientific and technical staff members.

The main objectives of SAIF are:

- To provide guidance for acquisition of data using sophisticated instruments
- To organize workshops on the use and application of various spectroscopic and analytical techniques for students, scientists, faculty members of CSIR-CECRI, other R&D laboratories, academic institutions and Industries
- To cater the needs of scientists and other users from various academic institutes, R&D laboratories, and industries to carry out cutting-edge research in different areas of modern science and technology by providing sophisticated analytical instrumental facilities

The instrumentation facilities available are grouped into the following eight categories:

- Optical spectroscopic techniques - ATR FT-IR, Laser Raman, UV-Vis absorption, UV-Vis-NIR Fluorescence
- Magnetic resonance techniques - NMR, EPR
- X-ray diffraction/scattering techniques - Powder and thin film XRD, SAXS/WAXS
- X-ray spectroscopy and surface science - XPS
- Imaging techniques - SEM, FE-SEM, TEM, HR-TEM, AFM, STM
- Chromatographic techniques – GC-MS, HPLC, GPC
- Thermal analyses – TG-DTA, DSC
- Elemental analysis – CHNS, AAS, XRF

The analytical instrumentation facilities are being availed by ~200 internal users and 250 external users annually. A new portal for analytical facilities has been created as per CSIR guidelines to list out all the available facilities at CSIR-CECRI (www.http://cecri.res.in/saif/). SAIF has developed an exclusive web portal to manage the request of internal users in a transparent manner. SAIF user committee consisting of chairman, scientific and technical staff members meets bi-monthly to prioritize the users' requests for sample analysis in an unbiased manner and fixing the analysis timings. The list of final allocation of sample analysis is being publicized in the intranet web portal of CSIR-CECRI.

Salient features of the SAIF portal:

- The portal describes the state-of-the-art centralized instrumentation infrastructure available at CSIR-CECRI.
- The details of services offered such as training programmes, refresher courses, certificate courses, and project guidance are provided as separate links.
- An online brochure is hosted with each instrument that contains the make, model, technical information, software used and other details about the instrument.
- The analysis charges for various analytical instruments for various categories (Industries, R&D labs, academic Institutions) are displayed as a separate link for the benefit of the users.
- A complete list of staff handling various instruments with their name and contact details (phone and e-mail) is also displayed for any queries/clarification from the users' for using the instruments.
- It is also envisaged to extend the features of the portal to accommodate all other equipments/instruments available at CSIR-CECRI.

The following instruments were installed in the SAIF during 2017-'18:

Laser Raman Spectroscopy, Horiba - April 2017 and XPS - ESCALAB 250Xi, Thermo Fisher Scientific - April 2017

Orientation Programme

SAIF organizes an orientation programme and conducts various workshops for the newly joined scientists and scholars at CSIR-CECRI on the following topics:

- An introduction to instrumental methods of analysis – spectroscopy – basics
- An introduction to instrumental methods of analysis – basics
- High power (9 kW) multipurpose XRD
- X-ray photoelectron spectroscopy

HORTICULTURE

CSIR-CECRI spreads over an area of 315 acres of land with the serene and green environment. The campus has diversified vegetation, laboratory space, residential area, health center, school, playground and community center. To promote the plantation drive, the horticulture section has developed a new plantation zone where distinguished visitors/guests who visit CSIR-CECRI on various occasions planted saplings to cherish the memory of their visit. To honour the staff members who retire from service, the horticulture section facilitates to plant a sapling in the commemorative plantation zone to cherish their memory of service. The commemorative plantation zone is maintained properly with care. New plant varieties including sandal-wood saplings had been planted in the vast unutilized area and maintained well. Six years ago, the horticulture section planted some sandalwood saplings that are grown well irrespective of the changing climatic conditions. New saplings were planted on both the sides of roads in CSIR-CECRI campus.

Apart from day-to-day works, horticulture section extended its activities on various important events and occasions viz., Prime Minister's Clean India Movement, 'Swachhata Pakhwada' Programme, Gandhi Jayanthi, Dengue Awareness Campaign, Colony Affairs activities, Birth Anniversary of Dr. B. R. Ambedkar, etc. In collaboration with the other service sections, the horticulture section rendered its service in many activities, for example, clearance of electric lines (by pruning the branches of trees), cleaning of bushes on the roadsides, clearing of bushes in the residential area and roadsides, cleaning of water tanks, etc.



Vermicompost final product

To recycle the food waste, leaf litter and other bio-wastes into valuable eco-friendly fertilizer, vermicompost production units were started in CSIR-CECRI campus recently, which reduces the consumption of chemical fertilizers for orchard and nursery plants.



Vermicompost pits



Inauguration of Swachh Bharat Mission programme

INVITED LECTURES

No.	Title of lecture	Speaker	Date
1	Future Energy Sources: Exploring Alternative Ways (National Technology Day Lecture)	Dr. S. S. V. Ramkumar, Director (R&D), Indian Oil Corporation Ltd., Faridabad.	11.05.2017
2	Tuning the surface Properties of graphite felt electrodes to enhance the perfor-mance of the vanadium redox flow batteries	Dr. Ditty Dixon, Anorganische Chemie, Karlsruhe Institute of Technology, Germany.	13.06.2017
3	Water Soluble Fullerenes for Materials Science & Medical Applications	Dr. S. V. Eswaran, Honarary Visiting Scientist, Regional Centre for Biotechnology [RCB], Faridabad & Hony. Emeritus professor, AcSIR, New Delhi.	06.07.2017
4	Technology Vision 2035 for India (CSIR-CECRI Foundation Day Lecture)	Padma Vibhushan Dr. Anil Kakodkar, President, National Academy of Sciences, India. Chairman, Rajiv Gandhi Science & Technology Commission. Chairman, TIFAC, Mumbai.	25.07.2017
5	Research Trends in Clean Energy Harvesting and Storage: Material Innovation holds the key (CSIR Foundation Day Lecture)	Prof. Satishchandra B. Ogale, Indian Institute of Science Education and Research (IISER), Pune.	25.09.2017
6	Rational Design of Electrode Materials for Beyond Li-ion Batteries	Dr. Premkumar Senguttuvan, Asst. Professor, New Chemistry Unit, International Centre for Materials Science, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru.	06.10.2017
7	My Vision: Corruption Free India	Prof. Caroline Nesabai, Lady Doak College, Madurai.	03.11.2017
8	Microenergetic Systems with Harvesting Energy	Prof. Iren Kuznetsova, Head of Post-Graduate Study Department, Principle Scientific Researcher, Kotel'nikov Institute of Radio Engineering & Electronics of RAS, Moscow, Russia.	14.11.2017
9	Coupling Smart Molecules into Chips	Dr. Roberto Pilloton, Sr. Scientist, Consigilia Nazionale Delleriserche, Rome, Italy.	16.11.2017
10	Materials and Systems for High Energy Density Batteries for Automotive and Grid Storage	Prof. Jagjit Nanda, Sr. Staff Scientist and Team Lead, Materials Science & Technology Division, OAK RIDGE National Laboratory, USA.	29.11.2017

No.	Title of lecture	Speaker	Date
11	Systematic Material Design of Electrocatalysts and Electrolyte Membranes for Fuel Cells	Prof. Takeo Yamaguchi, Laboratory for Chemistry and Life Science, Institute of Innovative Research, Tokyo Institute of Technology, Japan.	11.12.2017
12	Multiscale Morphological and Mechanical Characterization of Structured Semi-Crystalline Polymers	Dr. Andrea Sorrentino, Dr. Giovanni Landi, Institute of Polymers, Composites and Biomaterials (IPCB), National Research Council of Italy (CNR), Portici (NA), Italy.	12.12.2017
13	Solid-State Battery and Hybrid Power Systems	Dr. Jitendra Kumar, University at Dayton Research Institute, Dayton, USA.	12.12.2017
14	Microscale Energy Storage Devices Based on Two-Dimensional Transition Metal Carbides (MXenes)	Dr. Narendra Kurra, Postdoctoral Researcher, Drexel University, PA, USA.	12.12.2017
15	Large Energy Storage Options for Smart Grid	Prof. Mahabala Adiga, University of Toledo, USA.	22.12.2017
16	Effect of Atmosphere and Light on Photoluminescence Intensity Fluctuations of Hybrid Perovskite Microcrystals	Prof. Shaibal K. Sarkar, Dept. of Science and Engineering, Indian Institute of Technology (IIT), Bombay	14.02.2018
17	Design of Electroceramics by Structure-Property Correlation	Dr. A. K. Tyagi, Sr. Professor (Chemistry) & Head, Nuclear & Energy Materials Sector, Bhabha Atomic Research Centre (BARC), Mumbai.	16.02.2018
18	Symmetry and Structure in the Solid State	Prof. T. N. Guru Row, Honorary Professor & J.C. Bose National Fellow, Solid State and Structural Chemistry Unit, Indian Institute of Science (IISc), Bengaluru	28.02.2018
19	Crystal Engineering of Photoluminescent Chromium Molybdate-based Solids Molecular Insights	Prof. A. Ramanan, Department of Chemistry, Indian Institute of Technology (IIT), Delhi	12.03.2018

LECTURES DELIVERED

Speaker	Title	Venue, Event and Date
Dr. M. Anbukulandainathan	Electrochemical reduction of CO_2 to smaller organic molecules	Loyola College, Chennai. Dr. Yeddanapalli Memorial Lecture-2018. February 15, 2018.
	Electroanalytical techniques - CV, transient techniques and DEMS	Loyola College, Chennai. Workshop on Research Methodology. November 25, 2017.
Dr. Santoshkumar D. Bhat	Recent advances in methanol fuel cells technology	Cochin Ship Yard, Kochi. August 14, 2017.
Dr. V. Ganesh	Electrochemical biosensors for clinical diagnostics - Impact of a multidisciplinary approach	K.S. Rengasamy College of Arts and Science, Tiruchengode, Tamil Nadu. National Conference on Recent Advancements in Biomedical Techniques: Impact on Clinical Diagnosis. February 01, 2018.
	Exotic electrochemical processes at interfaces and their impact on human life	The American College, Madurai. One Day National Symposium on Recent Trends in Chemistry - 2018. January 18, 2018.
	Fourier transform infrared (FTIR) and Raman spectroscopic techniques - Fundamentals, principles, instrumentation, and applications	ACCET, Karaikudi. Faculty Development Programme. November 24, 2017.
	Importance of multidisciplinary approaches in electrochemical biosensors	Sathyabama Institute of Science and Technology, Chennai, Tamil Nadu. Recent Trends in Thin Film Development and Their Applications in Biomedical and Biosensor Devices. March 16, 2018.
	Multidisciplinary approach for renewable energy generation and conversion - Electrochemical perspective	Sree Siddaganga College of Arts, Science & Commerce, Tumakuru, Karnataka. National Conference on "Non-Conventional Energy Sources - The Need of the Hour". February 09, 2018.
	Scanning probe microscopy (SPM) - beyond imaging (data visualization and analysis)	Bishop Heber College, Trichy. February 16, 2018.

Speaker	Title	Venue, Event and Date
Dr. V. Ganesh	Science - The way for future	Fatima College, Madurai. National Science Day Celebrations. February 28, 2018.
	Voltammetric techniques	Periyar University, Salem, Tamilnadu. National Workshop on "Spectral, Electrochemical and Analytical Techniques" (SEAT - 2018). February 08, 2018.
Dr. V. V. Giridhar	Development of polymer electrolyte fuel cells for smart grid applications	Indian Institute of Technology (IIT), Roorkee. National Workshop on Power Electronics (NWPE- 2017)"; Theme - Strengthening Grid Energy Storage through Power Electronics - Challenges and Opportunities. October 09, 2017.
Dr. M. Jayakumar	Electroanalytical techniques	Islamiah College (Autonomous), Vaniyambadi, Tamil Nadu. National Workshop on "Sophisticated Instrumentation for Chemical and Physical Analysis". March 05, 2018.
	Electroplating: Fundamental aspects and practical considerations	Vivekananda College, Sangagiri. Workshop on "Electroplating: Fundamental aspects and Practical Considerations". February 14, 2018.
	Room temperature ionic liquids for electrochemical applications	MAMO College, University of Calicut, Manassery, Kerala. National Seminar on "Green Approaches to Chemistry Research". February 28, 2018.
	Structural and electrochemical properties of layered Nax(NiCo)yMn$_{1-2}$yO$_2$ (x = 0.5, 0.8, 1.0) as cathode material for sodium-ion batteries	Indian Institute of Science (IISc), Bengaluru. International Conference on Electrochemical Science & Technology (INCONST-17). August 11, 2017.
Dr. L. John Berchmans	Advanced materials for electronics	TRB Engineering College. Trichy. August 31, 2017.
	Advanced materials for energy and energy storage devices	SRM Institute of Technology, Chennai. March 09, 2018.

Speaker	Title	Venue, Event and Date
Dr. L. John Berchmans	Materials for energy and energy conversion systems	Central University, Pondicherry. March 29, 2018.
	Molten salt processing of reactive, refractory metals and alloys	PSG College of Technology, Coimbatore. May 05, 2017.
	Pyrometallurgical processes for the extraction of strategically important metals and materials	Central University, Pondicherry. March 29, 2018.
	Surface engineering of materials	Central University of Tamilnadu, Thiruvarur. August 23, 2017
Dr. Karthik Krishnan	Phase identifications of semiconducting materials by laser Raman spectroscopy	Bishop Heber College, Trichy, India. February 16, 2018
	Structure-property relationship in thin films for atomic scale devices & STM	Alagappa Chettiar College of Engineering and Technology, Karaikudi, India. November 21 – December 04, 2017
Dr. N. Lakshminarasimhan	Following-up the unusual results in photofunctional materials	VIT University, Vellore. July 11, 2017.
	Nanoscience and nanotechnology: small size, big impact	Dr. Umayal Ramanathan College for Women, Karaikudi. Faculty Development Programme. July 13, 2017.
	Photofunctional materials for energy harvesting and lighting applications	Coimbatore Institute of Technology Coimbatore. Smart Advanced Materials (SAM). November 10, 2017
	Science and engineering for inventing technologies	Abdul Hakeem College of Engineering and Technology, Melvisharam, Vellore District. PHENMACH-17. October 20, 2017.
	Surface modification and local symmetry control for tuning the properties of photofunctional materials	Bannari Amman Institute of Technology, Sathyamangalam, Erode District. International Conference on Advanced Materials Science and Technology (ICAMST - 2017). August 18, 2017
Dr. A. Manokaran	Hydrometallurgical process for the secondary recovery of lead – A review	ILZDA / The Battery Society of India, Bengaluru. National Conference of Lead Batteries; New Challenges & Opportunities. November 27-28, 2017.
Dr. V. Murugan	Electrochemical biosensor interventions for early diagnosis of eye disease biomarkers	Sankara Nethrayala, Chennai, Tamil Nadu. Cornea and Ocular Surface Symposium (SYNERGY-2018). March 24-25, 2018.

Speaker	Title	Venue, Event and Date
Dr. V. Murugan	Surface-functionalized micro/nanoarchitecture implications for anti-microbial and biosensor application	Thiruvalluvar University College of Arts and Science (TVUCAS), Vandavasi, Tamil Nadu. National Conference on Recent Advanced Materials-2018. February 23-24, 2018.
Dr. A. Pandikumar	Functional materials for dye-sensitized solar cells	Sethupathy Government Arts College, Ramanathapuram, Tamil Nadu. National Seminar on New Materials Research and Nanotechnology (NSNMRN-2018). March 19-21, 2018.
	Graphene-based nanocomposite materials for electrochemical sensing of biomolecules and environmentally hazardous substances	Bharathidasan University, Tiruchirappalli, Tamil Nadu. "Materials Science - 2018". March 05, 2018.
	Interfacial engineering in functional materials for dye-sensitized solar cells and photoelectrocatalysis	Bharathidasan University, Tiruchirappalli, Tamil Nadu. "Materials Science - 2018". March 05, 2018.
	Interfacial engineering in functional materials for dye-sensitized solar cells	Scott Christian College, Nagercoil, Tamil Nadu. Recent Advancements in Materials Science (RAMR-2018). March 16, 2018.
	Interfacial engineering on the design of nanocomposite materials for dye-sensitized solar cells	Kalasalingam Academy of Research and Education, Krishnankoil, Tamil Nadu. National Seminar on Technologically Important Crystalline and Amorphous Solids (TICAS 2018). March 02-03, 2018.
	Marriage between semiconductor-metal nanoparticles and its application in photoelectrocatalytic oxidation of small organic molecules	Anna University - BIT campus, Tiruchirappalli, Tamil Nadu. 3rd National seminar on Advanced Oxidation Processes, (AOP-2017). December 17-19, 2017.
	Materials aspects in photoanode materials for dye-sensitized solar cells	Periyar University, Salem, Tamil Nadu. National Level Workshop on Career and Research Opportunities in Sustainable Energy Sectors. March 08-09, 2018.
	Rational design and fabrication of photoanode materials for high performance dye-sensitized solar cells	A.V.V.M Sri Pushpam College, Poondi, Tamil Nadu. 3rd National Conference on Recent Trends in Nanomaterials and Thinfilms Research (RTNMTR-2018). February 09-11, 2018.
	Role of functional materials in high performance dye-sensitized solar cells	National College, Tiruchirappalli, Tamil Nadu. International Conference on Recent Advances in Materials-ICRAM 2018. March 22-23, 2018.

Speaker	Title	Venue, Event and Date
Dr. Poonam Singh	Corrosion of metallic biomaterials and its prevention	Alagappa University, Karaikudi. National level conference on Trends in Microbiology (NCTM- 2017). September 29, 2017.
Dr. S. Radhakrishnan	Role of analytical instrumentation in life science	Seethalakshmi Achi College for women, Pallthur, Sivagangai District. August 17, 2017.
Dr. P. Ragupathy	Energy storage technology: "Great challenges and opportunities	Bishop Heber College, Trichy. December 19, 2017.
	Recent trends in energy storage technology	Thanthai Hans Roever College, Perambalur. January 31, 2018.
Dr. K. Ramesha	High-performance Li-S batteries through surface functionalization of the separator	Pondicherry University, Pondicherry, India. First World Conference on Solid Electrolytes for Advanced Applications: Garnets and Competitors. September 06-09, 2017.
Dr. J. Ravindran	Microbes in coral reefs and their importance in ecology & biotechnology -An introduction	Central University, Tiruvarur, Tamil Nadu. March 08, 2018.
Dr. M. Sathish	Advanced nanomaterials in energy storage applications	Coimbatore Institute of Technology Coimbatore. Advanced Materials Science & Engineering: Nano-Bio 2017. November 09, 2017.
	Bio-mass derived renewable carbon materials for electrochemical supercapacitor applications	Bannari Amman Institute of technology, Sathyamangalam, Tamil Nadu. National Conference on "Challenges in Energy Conversion and Environmental Applications". March 23, 2018.
	Carbon/carbon-based nanocomposite materials for electrochemical supercapacitors applications	Mahendra Engineering College (Autonomous), Namakkal. National Conference on Advanced Materials for Photovoltaic and Supercapacitors (NCAMPS '17). November 23, 2017.
	Carbon-based materials for electrochemical energy storage	Thiagarajar College of Engineering, Madurai. Workshop on "Recent Advances in Materials for Photovoltaic Cell and Energy Storage Devices". February 22, 2018.
	Electrochemical energy storage devices-An overview	Thiagarajar College of Engineering, Madurai. Workshop on Frontiers in Materials Research for Energy Applications. December 12, 2017.

Speaker	Title	Venue, Event and Date
Dr.M Sathish	Materials and devices for electrochemical energy storage	VIT-Chennai campus, Chennai. November 01, 2017.
	Materials characterization: Fundamentals and recent developments	Dhanalakshmi Srinivasan College of Arts and Science for Women, Perambalur, Tamil Nadu. National Seminar on "Contemporary Applications in Material Science and Technology". February 28, 2018.
	Nanomaterials for supercapacitor applications	PSG College of Technology, Coimbatore. National Conference on "Emerging Materials for Sustainable Future". February 09, 2018.
	Recent developments in advanced nanomaterials for energy storage and conversion applications	Coimbatore Institute of Technology Coimbatore. Smart Advanced Materials (SAM). November 10, 2017.
	Solar hydrogen production - dream or reality?	Periyar University, Salem, Tamil Nadu. Workshop on "Renewable Energy Resources". March 26, 2018.
	XPS, Electron microscopy characterization techniques	National College, Tiruchirappalli. National Seminar on "Recent advances in Materials Characterization". March 02, 2018.
Dr. S. Sathiyanarayanan	Corrosion protection through paint coatings	CSIR-Human Resource Development Centre, Ghaziabad. Managing Corrosion in the Oil and Gas Section. January 30-31, 2018.
	Intelligent coatings	SSPC India. Hotel Rodas, Powai, Mumbai. International Conference on New Vistas in Surface Engineering and Corrosion Protection Strategies. September 15-16, 2017.
	Materials protection	Dr. Umayal Ramanathan College for Women, Karaikudi. Faculty Development Programme. 12th July, 2017.
	Smart coatings for corrosion protection	Indian Institute of Science (IISc), Bengaluru. International Conference on Electrochemical Science & Technology (INCONST-17). August 10, 2017.
Dr. Shailendra K. Jha	Anomalous dynamics of lithiation-induced stress: Improving the stability of lithium-ion battery anodes through interfacial and resistivity effects at the Si/Cu interface	Indian Institute of Technology (ISM) Dhanbad, Jharkhand. Recent Advances in Materials for Sustainable Energy (RAMSE - 2018). March 03-05, 2018.

Speaker	Title	Venue, Event and Date
Dr. Shailendra K. Jha	Rational design of nanomaterials for electrochemical detection of dopamine	Tata College, Kolhan University, Chaibasa, Jharkhand. National Conference on Enhancing New Innovation and Challenges in Nano, Chemical and Biological Sciences. February 16-18, 2018.
Dr. Sheela Berchmans	Functionalization of electrode interfaces: Applications in catalysis and sensing	St. Theresa's College, Ernakulam, Kerala. "Women achievers in science series". February 23, 2018.
	Nanomaterials for electrochemical sensors and energy storage	Pondicherry University, Pudhucherry. March 29, 2018.
Dr. V. Sivashanmugam	1. Lithium-ion battery testing and safety, 2. Battery enclosures	Underwriters Laboratory, Bengaluru. July 06-07, 2017.
Dr. Subbiah Alwarappan	Electrochemical biosensors - Past, present and future	Madurai Kamaraj University, Madurai, Tamil Nadu. March 19, 2018.
	Materials characterization - Why is it important?	Alagappa University, Karaikudi, Tamilnadu, India. February 01, 2018.
	Nanobiosensors in health care	Mother Teresa University Regional Campus, Madurai, Tamilnadu. Workshop on Medical Devices. March 28, 2018.
	Nanomaterials for multifunctional applications	Pondicherry University, Pudhucherry. March 22, 2018.
Dr. B. Subramanian	Biocompatible and biodegradable coatings by physicochemical methods	Sathyabama Institute of science and technology Chennai, Tamil Nadu. Workshop on Recent Trends in Thin Flim Development and their Applications in Biomedical and Biosensor Devices. March 12-28, 2018.
	Biocompatible and biodegradable coatings by physicochemical methods for implants	Tokyo Medical and Dental University, Tokyo, Japan. Institute of Biomaterials and Bioengineering seminar. September 29, 2017.
	Functional biomaterials	Thiagarajar College of Engineering, Madurai. Research Advances in Materials Science (RAMS2017). December 20, 2017.
	Functional bio-materials & applications	Alagappa Chettiar Government College of Engineering and Technology, Karaikudi. AICTE - QIP sponsored Two weeks FDP on Thin Deposition and Characterization (TFDC 2017). December 04, 2017.
	i) Fabrication of bio-interfaces for orthopedic implants and ii) Magnesium alloys as degradable biomaterials.	VRS College of Engineering and Technology, Villupuram, Tamil Nadu, India. June 30, 2017.

Speaker	Title	Venue, Event and Date
Dr.B. Subramanian	Materials for biomedical applications	K. Ramakrishnan College of Technology, Tiruchirapalli, Tamil Nadu. Second International Conference on Newer Engineering Concept and Technology (ICONNECT2K18). March 23, 2018.
	Materials for biomedical applications	Shanmuganathan Engineering College Pudukottai. National Level Technical symposium TECHIEFEST. February 10, 2018.
	Nanolayers by physicochemical methods	Kalasalingam Academy of Research & Education, Virudhunagar, Tamil Nadu. National Seminar on Advanced Materials. March 05, 2018.
	Surface coatings for implants	Kalasalingam University, Tamil Nadu. Faculty Development Programme. July 25, 2017.
	Thin film biointerfaces	Nagoya Institute of Technology, Nagoya, Japan. September 26, 2017.
Dr. G. Subramanian	Marine corrosion - A broad perspective	Nainar Pillai Memorial Government ITI, Aryanad, Kerala. June 30, 2017.
	Life science & global warming	Syed Hameedha Arts and Science College, Kilakarai, Ramnad District, Tamil Nadu. National Seminar on "Modern Enhancement in Life Science". March 16, 2018.
	Eco-friendly technology for derusting iron and steel components	The Monarch Industrial Products (I) Pvt. Ltd., Theni, Tamil Nadu. July 27, 2017.
	Marine fouling and its control	Indian Institute of Science (IISc), Bengaluru. International Conference on Electrochemical Science & Technology (INCONST-17). August 10, 2017.
Dr. Thirumalai Parthiban	Computer networks	Dr. Umayal Ramanathan College for Women, Karaikudi. October 13, 2017.
Dr. D. Vasudevan	Applications of IR, Raman, UV-Visible, and NMR spectroscopy in research	Rajeev Gandhi Memorial College of Engineering and Technology, (RGMCET), Nandyal, Andhra Pradesh. National Science Day Celebrations. February 27, 2018.
	Basic spectroscopy combined spectral problems on UV-Visible, IR, NMR and mass spectroscopy	Amritha School of Pharmacy, Kochi. Workshop on Spectral Data Analysis. December 15-16, 2017.

Speaker	Title	Venue, Event and Date
Dr. D. Vasudevan	Chemical and lab safety, and cyclic voltammetry	Madurai Kamaraj University, Madurai, Tamil Nadu. March 21, 2018.
	Electro-organic synthesis and electrocatalytic reactions	Amity University, Noida, UP. November 22, 2017
	Modified electrode materials in organic synthesis	Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu. "Challenges in Energy Conversion and Environmental Applications". March 23, 2018.
	Organic electrocatalysis	Vivekananda College, Chennai. January 11, 2018.
	Organic electrochemistry	Gurunanak College, Chennai. February 05, 2018.
	Organic spectroscopy	Bharathi Women's College, Chennai. February 02, 2018.
	Recent trends in electrocatalysis	Madras University, Chennai, Tamil Nadu. International Conference on Recent Trends in Analytical Chemistry, (ICORTAC-2018). March 15, 2018.
	Water pollution and its treatment	NSN College of Engineering & Technology, Karur. National Level Technical Seminar. December 06, 2017.
Dr. R. Vedalakshmi	Corrosion and its mitigation in marine concrete structures	i-Steel Corporation, Chennai. September 14, 2017.
Dr. D. Velayutham	Development & applications of electro-organic synthesis commercially / industrially attractive	Jubiliant Global R&D Meet 2017, New Delhi. July 10, 2017
Dr. Vijayamohanan K. Pillai	Applications of nanotechnology for electrochemical energy generation and storage	University of Mysore, Mysore. International Conference on Nanomaterials and their Applications. March 02, 2018.
	Can nano-carbon based electrocatalysts help to realize Pt-free fuel cells?	Bharathidasan University, Tiruchirappalli. Asia-Pacific Academy of Materials (APAM) Special Lecture Series. February 13, 2018.
	Can nano-carbon based electrocatalysts help to realize Pt-free fuel cells?	CSIR-NCL, Pune. Conference on Sustainable catalytic technologies. June 9, 2017.
	Can nano-carbon based electrocatalysts help to realize Pt-free fuel cells?	Indian Institute of Science (IISc), Bengaluru. International Conference on Electrochemical Science and Technology (ICONEST-2017). August 10, 2017.

Speaker	Title	Venue, Event and Date
Dr. Vijayamohanan K. Pillai	Chemistry and the world of intelligent materials	Farook College, Calicut. International Conference on Emerging Frontiers of Chemical Science (EFCS-2017). September 23-25, 2017.
	Electrochemical preparation of quantum dots from three-dimensional analogues	Annamalai University, Chidambaram. Recent Trends in Synthetic Methods and Material Chemistry (RTSMC-2018). February 02, 2018
	Electrochemical preparation of quantum dots of two dimensional materials	University of Madras, Chennai. International Conference on Recent Trends in Analytical Chemistry (ICORTAC 2018). March 15, 2018.
	Emerging world of engineered nanocarbon for electrochemical Energy Storage	Assam University, Silchar. National Conference on Emerging Materials (NCEM-2018). March 20, 2018.
	Energy storage; India's challenges and possible solutions	HP Green R&D Centre, HPCL, Bengaluru. Workshop on 'Battery Technologies and Electric Mobility'. March 08, 2018.
	Heteroatom engineering in graphene: Incorporation of heteroatoms into graphene quantum dots and graphene nanoribbons and its applications in electrocatalysis	Indian Institute of Technology (IIT), Ropar. May 15-16, 2017.
	How chemistry helps to solve energy related challenges	Mepco Schlenk Engineering College, Sivakasi. Workshop on Frontier Areas in Materials Chemistry. January 19, 2018.
	How does nanotechnology help to make cheaper fuel cells?	Hotel The Lalit Ashok, Bengaluru. 9th Bengaluru INDIA NANO 2017 Conference. December 07, 2017.
	Impact of nanotechnology on corrosion research	CSIR-Human Resource Development Centre, Ghaziabad. Managing Corrosion in the Oil and Gas Sector. January 30, 2018.
	S&T developments in India on chemistry	India-Turkmenistan Round Table Meeting at INSA, New Delhi. December 04, 2017.
	Electrochemical energy storage: sustainable options for the future using engineered carbon	Sacred Heart College, Kochi, Kerala. 16th Prof. K. V. Thomas Endowment Workshop 2018. January 15, 2018
	What is "Super" about supercapacitors?	Sacred Heart College, Kochi, Kerala. 16th Prof. K. V. Thomas Endowment Workshop 2018. January 15, 2018.

HONORS/AWARDS/RECOGNITIONS/FELLOWSHIPS

Scientists

Name	Honor/award/recognition/fellowship
Dr. M. Anbukulandainathan	Tamilnadu Scientist Award - 2013
	Rev. Dr. Yeddanapalli Memorial Award 2018 by Department of Chemistry, Loyola College, Chennai.
Dr. V. Ganesh	Best Scientific Researcher Award for the year 2017 by Association for Scientists, Developers, and Faculties (ASDF)
Dr. Santoshkumar D. Bhat	Outstanding Scientist Award - 2017 from Venus International Foundation
Dr. S. Sathiyanarayanan	Received the Mascot National Award- 2017 from the Electrochemical Society of India, Bengaluru.
	Tamil Nadu Senior Scientist Award - 2016 in the discipline of Chemical Sciences.
Dr. Subrata Kundu	Honorary Fellow of the Australian Institute of High Energetic Materials, Australia
	Outstanding Scientist Award - VIRA-2017 from Venus International Foundation.
	Best Scientific Researcher Award for the year 2017 by Association for Scientists, Developers, and Faculties (ASDF)
Dr. G. Subramanian	Outstanding Scientist Award - 2017 from Venus International Foundation
	Lifetime Achievement Award in the field of Corrosion and Fouling by Venus International Research Foundation, Chennai.
Dr. S. Vasudevan	Honorary Fellow of the Australian Institute of High Energetic Materials, Australia
	Best Scientist Award by M/s EET CRS Research and Branding Company, Noida, New Delhi.
Dr. S. Vengatesan	Honorary Fellow of the Australian Institute of High Energetic Materials, Australia
Dr.Vijayamohanan K. Pillai	Honorary Fellow of Electrochemical Society of India (ECSI), Bengaluru.
	Elected as a Fellow of Indian National Science Academy (2018) for his important contributions to Materials, Electrochemistry and their applications in molecular electronics and energy storage.

Research Scholars/Fellows/Project Assistants

Name	Honor/award/recognition/fellowship
Mr. S. Anantharaj (CSIR-SRF)	Inaugural winner (2017) of the ECS India Section "S.K. Rangarajan Graduate Student Award"
	Best Oral Presentation Award in the "International Conference on Advanced Nanomaterials (ICAN)" held at Alagappa University, Karaikudi during February 26-27, 2018.
Mrs. S. Jayashree (DST INSPIRE-SRF)	Bhaskara Advanced Solar Energy (BASE) Fellowship for the year 2018 by the DST and the Indo-U.S. Science and Technology Forum (IUSSTF).
Ms. O. V. Manila (CSIR-SRF)	Newton-Baba Fellowship funded by Department of Biotechnology (DBT) and British Council. Name of the UK Host institute: Ulster University, Coleraine.
Mr. N. Mohammed Azeezulla (CSIR-SRF)	Best Oral Presentation Award in the International Conference - ICETCS-2017 held at MIT, Manipal.
Mr. M. Praveen Kumar (SRF)	First Prize for the Poster Presentation on Titanium dioxide nanostructure for photoelectrochemical water splitting application in the 19th International Symposium on Eco-Materials Processing & Design held during February 21-25, 2018 at Jaipur.
	First Prize for the Poster Presentation in the 19th International Symposium held at Jaipur.
Ms. S. Premlatha (RGNF-SRF)	Best Paper Award in "2nd International Conference on Electrochemical Science & Technology" held during August 10-12, 2017, organized by Electrochemical Society of India and IISc, Bengaluru
Dr. T. Siva (Research Associate)	"Corrosion Awareness Award - 2017" for his contribution to the field of Corrosion Science and Technology. The award was presented by NACE International on September 19, 2017
Mr. K. Subramani (DST INSPIRE-SRF)	Best Paper Award for his Oral Presentation in National level Conference on "Reaching the Unreached Through Science and Technology - Concepts, Principles and Applications of Science and Technology for Nation Building", held on October 09-11, 2017 at Kongunadu Arts and Science College, Coimbatore.
Mrs. V. Sudha (UGC-SRF)	Best Poster Presentation Award in the International Conference on Advanced Nanomaterials (ICAN-2018) held during February 26-27, 2018 at Alagappa University, Karaikudi.
Mr. S. Suresh Balaji (CSIR-SRF)	Best Paper award in the International Conference on "Sustainable Environment and Energy (ICSEE' 17) organized by Hindustan University, Chennai during April 06-07, 2017.
Mr. C. Venkateswara Raju (CSIR-SRF)	Best Oral Presentation Award during the "2nd International Conference on Recent Trends in Analytical Chemistry (ICORTAC-2018)" organized by University of Madras held during March 15-17, 2018.



Dr. V. Ganesh receiving the prestigious ASDF global award for Best Scientific Researcher for the year 2017.



Dr. M. Anbukulandainathan, Scientist, CSIR-CSIR-CECRI receiving the "Tamil Nadu Scientist Award - 2013" for his outstanding contribution in the discipline of Chemical Sciences.



Dr. Vijayamohanan K. Pillai, Director, CSIR-CSIR-CECRI receiving the Indian National Science Academy (INSA) Fellowship Award during INSA Anniversary meeting held in IISER, Pune.



Dr. S. Sathiyanarayanan, Senior Principal Scientist, CSIR-CSIR-CECRI receiving the Mascot National Award- 2017 by 'The Electrochemical Society of India' at JN Tata Auditorium, IISc Campus, Bengaluru.



Dr. T. Siva receiving the "Corrosion Awareness Award – 2017" presented by NACE International for his contribution to the field of Corrosion Science and Technology



Dr. Subrata kundu, Scientist, ECMS Division, receiving the 'Outstanding Scientist' award VIRA-2017 from Venus International Foundation, Chennai.



Dr. G. Subramanian, Senior Principal Scientist, CSIR-CECRI Mandapam Unit receiving the "Lifetime Achievement Award in the field of Corrosion and Fouling" by Venus International Research Foundation, Chennai.



Dr. S. Sathiyanarayanan, Sr.Principal Scientist, CSIR-CSIR-CECRI receiving the "Tamil Nadu Senior Scientist Award - 2016" in the discipline of Chemical Sciences.



Dr. Subrata Kundu, Scientist, ECMS Division, CSIR-CSIR-CECRI receiving the "Best Scientific Researcher Award" for the year 2017 by ASDF during the ASDF Global Award Ceremony in Goa.



CSIR-CSIR-CECRI B-Tech Hand Ball Won III Place



Members of CSIR-CECRI cricket and volley ball teams created history by qualifying for the finals of SSBMT (Outdoor)



Mr. M. Praveenkumar, Research Scholar receiving the First Prize for Poster Presentation on Titanium dioxide nanostructure for photoelctrochemical water splitting application in the 19th International Symposium on Eco-Materials Processing & Design held in Jaipur.

हिंदी माह 2017

संस्थान में दि. 01 से 30 सितंबर, 2017 तक हिंदी माह मनाया गया । इस हिंदी माह के दौरान 9 प्रतियोगिताएँ आयोजित की गईं । इसमें संस्थान के कर्मचारियों के साथ – साथ कनिष्ठ/वरिष्ठ अनुसंधान अध्येताओं, बी. टेक के छात्रों एवं परियोजना सहायकों आदि ने भी भाग लिया ।

दैनिक हिंदी प्रश्नोत्तरी

हिन्दी माह का प्रारम्भ ऑनलाइन दैनिक हिंदी प्रश्नोत्तरी प्रतियोगिता से किया गया। दैनिक प्रश्नोत्तरी के अंतर्गत हिन्दी माह के दौरान इंट्रानेट पर मुख्यत राजभाषा हिंदी से सम्बद्ध कुल 15 प्रश्न पूछे गए, प्रतिभागियों ने ऑनलाइन हिन्दी टूल्स की सहायता से इन प्रश्नों के उत्तर ऑनलाइन ही दिए।

सुलेख प्रतियोगिता

संस्थान में दिनांक 14/09/2017 को हिंदी सुलेख प्रतियोगिता का आयोजन किया गया ।

अनुभागवार एवं प्रतियोगिता

इस के अंतर्गत अनुभाग विशेष के कार्य से सम्बद्ध शब्दावली पूछी गई थी। इन प्रतियोगताओं के पूर्व सभी प्रतिभागियों को ऑनलाइन हिन्दी टूल्स की जानकारी दी गई और ऑनलाइन टूल्स की सहायता से हिंदी अनुवाद, लिप्यान्तरण करने संबंधी अभ्यास भी कराया गया। प्रतिभागियों ने इन्हीं टूल्स की सहायता से प्रतियोगिता के प्रश्नपत्र हल किए। इसके अंतर्गत निम्नानुसार प्रतियोगताएं आयोजित की गईं :

1. दिनांक 22/09/2017 – स्थापना, बिल अनुभाग, वर्क्स एवं सामान्य तथा सिविल अनुभाग
2. दिनांक 27/09/2017 – लेखा अनुभाग, भंडार एवं क्रय अनुभाग, अन्य अनुभाग/प्रभाग के सहायक/निजी सहायक/निजी सचिवों के लिये

प्रश्नोत्तरी प्रतियोगिता

दि. 20.09.2017 को एक प्रश्नोत्तरी प्रतियोगिता आयोजित की गई . इसमें सामान्य ज्ञान, भाषा आदि पर दृश्य–श्रव्य माध्यम से द्विभाषी रूप में प्रश्न पूछे गए । कर्मचारियों ने पूरी रुचि के साथ इसमें भाग लिया . श्री थॉमस एलेक्सेण्डर, सुरक्षा अधिकारी ने इस प्रतियोगिता का संचालन किया ।



पोस्टर प्रस्तुतिकरण

दि. 21.09.2017 को पोस्टर प्रस्तुतिकरण प्रतियोगिता का आयोजन किया गया। इसमें वैज्ञानिकों के साथ–साथ, कनिष्ठ/वरिष्ठ अनुसंधान अध्येताओं, बी.टेक के छात्रों एवं परियोजना सहायकों ने भी भाग लिया।

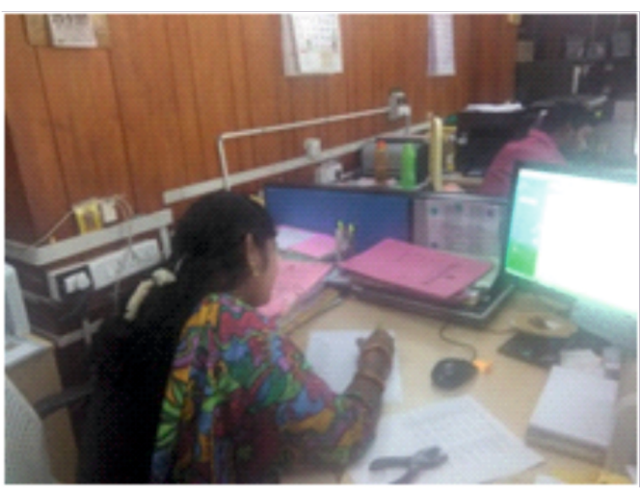
टिप्पण एवं आलेखन प्रतियोगिता

दि. 25.09.2017 को सभी कर्मचारियों के लिए टिप्पण एवं आलेखन प्रतियोगिता आयोजित की गई । प्रतिभागियों के अभ्यास के लिए प्रश्न पत्र का नमूना प्रतियोगिता से पूर्व डीबी पर प्रदर्शित कर दिया गया था।

हिंदी माह समापन एवं पुरस्कार वितरण समारोह

हिंदी माह 2017 – पुरस्कार वितरण समारोह दि. 06.11.2017 को अपराह्न 2.30 बजे संस्थान के अलगप्पा हॉल में आयोजित किया गया । श्री. के. आर. वैधीस्वरन, संयुक्त सचिव, सीएसआईआर, नई दिल्ली इस समारोह के मुख्य अतिथि थे । संस्थान के निदेशक डॉ. विजयमोहनन के. पिल्लै ने इस समारोह की अध्यक्षता की ।

सर्वप्रथम श्री क्रिस्तु राज, प्रशासन नियंत्रक ने मुख्य अतिथि एवं उपस्थित सभी का स्वागत किया तथा हिंदी माह के आयोजन के उद्देश्य तथा प्रयोजन पर प्रकाश डाला ।











डॉ. विजयमोहनन के. पिल्लै, निदेशक, सीईसीआरआई ने मुख्य अतिथि श्री. के. आर. वैधीस्वरन, संयुक्त सचिव, सीएसआईआर, नई दिल्ली का स्वागत किया । उन्होंने अपने अध्यक्षीय भाषण में कहा कि हिंदी माह की प्रतियोगिताओं में अधिक संख्या में भागीदारी कर्मचारियों में हिंदी के प्रयोग के प्रति बढ़ती रुची को दर्शाती है. संस्थान में हिंदी के प्रयोग में प्रगति हुई है परंतु अभी भी हम कुछ क्षेत्रों में राजभाषा कार्यान्वयन के लिए हमारे लिए निर्धारित वार्षिक लक्ष्यों से पीछे हैं, अतः हमें इस दिशा में और अधिक प्रयास करने की आवश्यकता है. उन्होंने सभी उच्चाधिकारियों से संसदीय समिति को दिए गए आश्वासनों का अनुपालन सुनिश्चित करने एवं तदनुसार हिंदी में अधिकाधिक कार्य करने के लिए कहा. इसके अतिरिक्त उन्होंने सभी कर्मचारियों से यह अपील की. कि वे अपने दैनिक कार्यालयीन कार्यों में राजभाषा हिंदी का अधिकाधिक प्रयोग करें.

संस्थान के हिंदी अधिकारी श्री सोमेश्वर पाण्डेय ने हिंदी माह 2017 के अंतर्गत आयोजित ऑफलाइन एवं ऑनलाइन प्रतियोगिताओं तथा संस्थान में हिंदी के प्रचार–प्रसार संबंधी वार्षिक गतिविधियों की जानकारी दी ।

समारोह के मुख्य अतिथि श्री. के. आर. वैधीस्वरन ने अपने भाषण में कहा कि सभी को हिंदी सीखनी चाहिए

और कार्यालयीन कार्यों में इसका प्रयोग भी करना चाहिए । यह हमारा संवैधानिक दायित्व भी है. उन्होंने कहा कि हालही में माननीय संसदीय समिति द्वारा निरीक्षण किया गया है तथा सभी को संसदीय समिति को दिए गए आश्वासनों का शतप्रतिशत अनुपालन सुनिश्चित करना चाहिए. उन्होंने हिंदी भाषा के प्रयोग के सम्बन्ध में कहा कि हमें सरल हिंदी, जिसमें तमिल, तेलगु, अंग्रेजी आदि के प्रचलित शब्द सम्मिलित हैं का ही प्रयोग करना चाहिए। उन्होंने हिन्दी माह के सफल आयोजन के लिए आयोजन समिति को बधाई दी तथा सभी पुरस्कार विजेताओं को शुभकामनायें दीं ।

तदुपरांत हिंदी माह के अंतर्गत आयोजित विभिन्न प्रतियोगिताओं के विजेताओं को मुख्य अतिथि श्री. के. आर. वैधीस्वरन द्वारा पुरस्कार वितरित किए गए तथा इन प्रतियोगिताओं में निर्णायकों के रूप में सहयोग देने वाले स्थानीय एवं बाह्य निर्णायकों/संचालकों को भी सम्मानित किया ।

हिंदी अधिकारी द्वारा धन्यवाद ज्ञापन के साथ यह हिन्दी माह 2017 – पुरस्कार वितरण समारोह संपन्न हुआ ।





IMPORTANT EVENTS

NATIONAL TECHNOLOGY DAY CELEBRATION

National Technology Day was celebrated at CSIR-CECRI, Karaikudi on May 11, 2017, marking the anniversary of Pokhran nuclear tests of 1998. In his welcome address, Dr. S. Mohan, Chief Scientist, CSIR-CECRI highlighted the technologies and processes that CSIR-CECRI had presented to the nation. Dr. S. S. V. Ramakumar, Director (R&D), Indian Oil Corporation Ltd., Faridabad was the chief guest and delivered the technology day lecture on future alternative energy sources. Dr. Vijayamohanan K. Pillai, Director, CSIR-CECRI introduced the chief guest and emphasized the importance of renewable energy research and applications. In his presidential remarks, he stressed about the pivotal role to be played by CSIR-CECRI in the field of energy storage and sustainability over the coming years.

In his lecture, Dr. Ramakumar recalled the major use of fossil fuels, their impact on the environment and emphasized that liquefied nitrogen gas (LNG), compressed natural gas (CNG), solar power and wind power are some of the foreseen alternative energy sources of the coming decades. He also highlighted the need of environment-friendly mobility and the pivotal role of labs like CSIR-CECRI in the development and dissemination of technology. The role of bio-diesel in augmenting the domain of energy utilization and requirement of improved bio-processes to produce high-efficiency ethanol for cleaner fuel were also mentioned. He further emphasized that the renewable energy generation will become more and more challenging when we consider storing the energy. Various kinds of batteries play a major role in the field of energy storage. Lithium-ion batteries are very good as far as performance is concerned. In a similar vein, lead acid, Na, Mg, and Metal (AI) Air batteries too are good for energy storage.



Dr. S. S. V. Ramakumar, Director (R&D), Indian Oil Corporation Ltd., Faridabad delivering a lecture on the occasion of National Technology Day (May 11, 2017)

These are economically viable and long-lasting in terms of power storage.

The programme concluded with the vote of thanks proposed by Dr. D. Jonas Davidson, Head, Technology Transfer and Business Development (TTBD) group of CSIR-CECRI.

70th CSIR-CECRI Foundation Day Celebration

The 70th CSIR-CECRI Foundation Day was celebrated on July 25, 2017. Padma Vibhushan, Dr. Anil Kakodkar, Former Chairman of the Atomic Energy Commission was the chief guest for the event and delivered the foundation day lecture. Dr. D. Velayutham, Deputy Director, CSIR-CECRI welcomed the gathering. Dr. Vijayamohanan K. Pillai, Director, CSIR-CECRI in his presidential address, emphasized the importance of scientists to prune their activities to those that impact the 125 million people of India. He also outlined a few time-bound activities that CSIR-CECRI has been pursuing in this direction. Dr. O. R. Nandagopan, Director, Naval Science and Technological Laboratory, Visakhapatnam extended his felicitations on the occasion.

In his foundation day lecture, Dr. Anil Kakodkar said that maintaining excellence in an expanding universe is a lot easier than in a steady-state universe. He also mentioned that several apparently average students surprise themselves and others with their achievements when they migrate to institutions in the west that offer a conducive innovative eco-system. India should evolve and nurture such an eco-system and respond to technology demands. Dr. Kakodkar said that creating such an eco-system needed a change in the mind set across all domains of society and breaking out from silo mentality. Enlightening the audience on Technology Vision for India 2035, Dr. Kakodkar said that the new vision betted on emerging technologies to overcome challenges in ensuring inclusive growth and improved quality of life. According to him such a technology leap must take advantage of India's democratic dividend and is a key driver to empower individuals, societies, and countries. The vision statement envisions India's technology future modes comparing it to four gaits of a horse: galloping, cantering, trotting and walking. India gallops in some areas such as space, nuclear, information and missile technologies, canters to keep pace in some others such as civil aviation and road transport, and trots in a few others such as food, manufacturing, and electronics. But it has not been able to

walk the talk in time in many areas such as room temperature superconductivity. India was for a very long stretch of time the No. 1 trading country in the world. We shone well during the agrarian era, but we missed the bus during the industrial era. Although India invests only 0.88% of its GDP in research and development programmes, the investment is huge in absolute terms considering the country's economy, and much above those of industrialized countries such as Israel, Canada, UK, Switzerland and Finland. But our R&D investment should be made more productive and industry-driven. It is sad that in most industries Indian expertise still lacks a global edge. We remain heavily dependent on many key foreign technologies. Moreover, the translation of research findings to commercialization is strapped for want of funds. It is, however, a matter of pride that despite foreign rule, and technology denial and embargos (typical ones being those that followed the 1974 and 1998 nuclear implosions), India has managed to fly its flag high. Today, countries such as Israel are keen on 'making together' with India. The only way to sustain the momentum is to become a major player in the technology-production game.

The programme concluded with vote of thanks proposed by Shri C. Christuraj, Controller of Administration, CSIR-CECRI.



Padma Vibhushan Dr. Anil Kakodkar, former Chairman of the Atomic Energy Commission delivering the CSIR-CECRI Foundation Day Lecture (July 25, 2017)

INDUSTRIAL CONCLAVE

CSIR-CECRI organized an "Industrial Conclave" at Hotel Green Park, Vadapalani, Chennai on August 19, 2017 showcasing its wide range of outstanding achievements and the presently available technologies that are potentially useful to cater the demands of various industrial sectors to solve the industrial and social problems.



Dr. Vijayamohanan K. Pillai, Director, CSIR-CECRI briefed about the Conclave, Dr. D. Velayutham, Chief Scientist, welcomed the gathering of scientists, industrial dignitaries, and participants. The conclave was inaugurated by the chief guest of the occasion, Dr. Ajaya Ghosh, Director, CSIR-National Institute of Interdisciplinary Science and Technology, Thiruvananthapuram. In his inaugural address, Dr. Ghosh emphasized the need for useful technological innovations that should be easily available and also improve the quality of the lives of the people of India.

Dr. B. Chandrasekaran, Director, CSIR-Central Leather Research Institute, Chennai presided over the function. In his presidential address, he commended the efforts of CSIR-CECRI in organizing the conclave. Prof. Santosh Kapuria, Director, CSIR-Structural Engineering Research Centre, Chennai released a video that highlights the various research activities and technological achievements of CSIR-CECRI. The video also explains the industry-relevant problems of the present times and elucidates various R&D pathways undertaken by the lab. A brochure detailing the ready-to-take technologies available in CSIR-CECRI was released by Dr. Pradeep Kumar Singh, Director, Central Institute of Mining and Fuel Research, Dhanbad. The brochure and video would together give a bird's eye view about CSIR-CECRI and serve as a guide and reference to the entrepreneurs/officials from the private sectors and also encourages a partnership among other R&D establishments and academia. Shri S. Rajagopalan, CEO, Ashley Alteams India





Ltd., released a brochure on sophisticated 3D printing technology. CSIR-CECRI had recently acquired a 3D printer, a machine capable of directly printing a computer model into a real-time object. This method is believed to have massive implications in electronics, aviation instrumentation, and lab medical devices. Dr. Om Prakash, Director of Boeing, India declared open the exhibition for the benefit of the industries and entrepreneurs. Boeing India has maintained a strong collaboration with CSIR-CECRI and has been actively encouraging and collaborating in the R&D works of CSIR-CECRI. Senior Scientists of CSIR-CECRI made focused thematic presentations on various technologies of CSIR-CECRI followed by brief comments on the technological expectations from the CSIR HQ by Dr. Hari Om Yadav.

A brief talk was given by Shri Sivaraja, CEO, Native Lead, Madurai. He mentioned about the progress and challenges of the booming start-up ecosystem in India and emphasized that the need of the hour is job-creation rather than job-seeking. Several participants from various industries including Berger paints, Asian paints, Boeing, etc., attended the conclave, visited the exhibition stalls and witnessed the live demonstrations of various technologies. This event has also created an opportunity for participants to meet the respective scientists in their field and interact with them head-on.

A special one-to-one discussion session was also organized wherein the representatives of the various participating private industries with the respective scientific community in order to update them of the current developments and the possibilities of coming up with novel solutions and potential collaborative "lab 2 industry" projects.

Dr. S. Mohan, Chief Scientist, CSIR-CECRI proposed the vote of thanks. Dr. Jonas Davidson, Head, Technology Transfer and Business Development (TTBD) group of CSIR-CECRI coordinated the entire programme.

CSIR FOUNDATION DAY CELEBRATION

The 75th CSIR Foundation Day was celebrated at CSIR-CECRI on September 25, 2017. Prof. Satishchandra B. Ogale, Department of Physics and Centre for Energy Science, Indian Institute of Science Education Research (IISER), Pune was the chief guest and delivered the Foundation Day lecture on "Research Trends in Clean Energy Harvesting and Storage: Materials Innovation Holds the Key". Dr. D. Velayutham, Chief Scientist, CSIR-CECRI welcomed the chief guest and the august gathering. He revealed the historical background of CSIR since its inception on September 26, 1942 with a small funding of Rs. 10 lakh a year. He mentioned that over the years, CSIR has grown up into a large and respected R&D organization of India with a dynamic 38 labs, having more than 13,000 employees and has taken the position of number 12 R&D organization in the global scenario.

Dr. Vijayamohanan K. Pillai, Director, CSIR-CECRI released the Annual Report of CSIR-CECRI for the year 2016-'17. He highlighted the importance of the Foundation Day and our roles and responsibilities as a scientific organization that meant to serve the society and industrial problems of India being a publicly funded organization. He emphasized that compared to many international universities of higher learning, CSIR in its 75th year is still at its infancy and we have a very long way to go, as more societal and industrial demands are created as the country grows in an economy with the population. He also reiterated that the



Professor Satishchandra B. Ogale, Indian Institute of Science Education and Research (IISER), Pune delivering the CSIR Foundation Day lecture (September 25, 2017)

importance to work hard, understand the requirements of our country and focus much towards achieving the objectives. He introduced the guest Prof. Satishchandra B. Ogale with his scientific credentials.

The chief guest, Prof. Satishchandra B. Ogale, delivered the CSIR foundation day lecture wherein he stressed upon the importance of scientific research and its relevance to India and ways in which we can improve it further to meet the future requirements. He compared the energy generation and usage per capita and urged for the need to develop innovative technologies. He highlighted the overlap of organic and inorganic materials research leading to novel hybrid materials with multifarious properties. He also threw light on exploring the usage of nanoparticles and quantum physics. Prof. Ogale also stressed the need for electric vehicles for public transportation, the urgency of newer energy storage techniques and the challenges ahead. He appreciated the CSIR-CECRI's R&D initiatives in this direction like lithium-ion batteries, fuel cells, etc., and advised the CSIR-CECRI fraternity to take a lead role in making our nation fully based on electric transportation and thereby reduce carbon footprint and leave the mother earth in good condition for future generation. Prof. Ogale also urged all the young scientists to collaborate with each other and share their scientific ideas for innovative research.

Prof. Ogale honoured the staff and scientists of CSIR-CECRI who had completed 25 years of service. Dr. D. Velayutham, Chief Scientist distributed the prizes to the wards of the staff and students who won the prizes in JIGYASA program of KV schools of southern districts. Shri C. Christuraj, Controller of Administration, CSIR-CECRI proposed the vote of thanks.

CSIR-CECRI OPEN DAY

As a part of the 75th CSIR Foundation Day celebrations, CSIR-CECRI observed Open Day on September 26, 2017. The general public and people from academic and business sector were given free entry into CSIR-CECRI to view and witness the scientific exhibitions, live experimental demonstrations, scientific models and posters, and technological achievements showcased by CSIR-CECRI Scientists, Technical Officers, and Research Scholars. Over 20,000 people had interaction with CSIR-CECRI scientific staff on this event.



Students observing the exhibition and interacting with a research scholar (September 26, 2017)



A section of students and public visiting the open day of CSIR-CECRI (September 26, 2017)

HINDI MONTH CELEBRATION

Hindi Month Celebration–2017 was organized on November 06, 2017 at CSIR-CECRI, Karaikudi. Shri K. R. Vaidheeswaran, Joint Secretary, CSIR, New Delhi was the Chief Guest and distributed the prizes and certificates to the winners of various Hindi competitions conducted for the staff/research scholars.



Hindi Month Celebrations (November 06, 2017)

NATIONAL SCIENCE DAY

National Science Day was celebrated on February 28, 2018 at CSIR-CECRI, Karaikudi. Professor T. N. Guru Row, Honorary Professor and J.C Bose National Fellow, Indian Institute of Science, Bengaluru delivered the National Science Day Lecture on "Symmetry and Structure in the Solid State". Oral and Poster presentation competitions for Ph.D. Scholars were conducted on the occasion of National Science Day and Prof. Guru Row distributed the prizes for the 12 winners of various competitions.



Professor T. N. Guru Row, Honorary Professor and J.C Bose National Fellow, Indian Institute of Science, Bengaluru delivering the National Science Day Lecture (February 28, 2018)

NATIONAL SAFETY DAY

National Safety Day was conducted at CSIR-CECRI on March 06, 2018. Shri T. Baskaran, Additional General Manager (HSE), BHEL, Tiruchirappalli was the Chief Guest for this event. Shri C. Christuraj, Controller of Administration, CSIR-CECRI, Karaikudi, welcomed the audience and Dr. Ganesan, Senior Principal Scientist and Chairman, Safety Cell, CSIR-CECRI detailed the various



Shri T. Baskaran, Additional General Manager (HSE), BHEL, Trichy delivering lecture (March 06, 2018)



Dr. Raja Vijayakumar, FTMO, CSIR-CECRI explaining first aid and emergency care measures (March 06, 2018)

safety measures regulated and followed in CSIR-CECRI. Dr. Vijayamohanan K. Pillai, Director, CSIR-CECRI presided over the programme. The Chief Guest, Shri Baskaran in his lecture on "Safety in Research Institutions", emphasized the need and importance of safety measures in research institutions, especially in the areas of batteries and electroplating. He urged everyone to follow safety measures in all walks of life to ensure zero incident/fatality. In view of the National Safety Day, an essay competition was conducted for research scholars and the prizes were distributed to the Winners by the chief guest.

To create awareness, Dr. Raja Vijayakumar, Full Time Medical Officer (FTMO), CSIR-CECRI delivered a lecture on "First Aid and Emergency Care". In his talk, he explained the first aid measures to be taken on emergency situations.

Shri L. Thomas Alexander, Security and Safety Officer, CSIR-CECRI proposed the vote of thanks.

INTERNATIONAL WOMEN'S DAY

International Women's Day was celebrated on March 27, 2018 at CSIR-CECRI, Karaikudi. Dr. S. Sangeetha, Obstetrics and Gynaecologist, Apollo Reach Hospitals, Managiri, Karaikudi was the Chief Guest of the function. Dr. D. Velayutham, Chief Scientist, Shri C. Christu Raj, Controller of Administration, and Dr. S. Sathiyanarayanan, Head, PPMG graced the occasion. Dr. Poonam Singh, President, CLF welcomed the delegates, participants, and winners of science awareness programme conducted for the benefit of rural school children along with CLF members. Dr. D. Velayutham delivered the presidential address and Sri. C. Christu Raj offered felicitations. Dr. S. Sangeetha,



International Women's Day celebration (March 06, 2018)

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International Yoga Day deomonstration (June 21, 2017)

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INTERNATIONAL YOGA DAY

On the occasion of International Day of Yoga, CSIR-CECRI Club arranged a lecture-cum-demonstration on June 21,

Programme	Activites
Swachhta awareness	Created the awareness. A message promoting the swachhta was displayed through digital boards, banners, posters, hoardings, pamphlets, slogans, etc., and organized swachhta awareness campaigns and special cleanliness drive in office premises and its surroundings.
Swachh Parisar (cleaning of workplace and residential areas)	Cleaned the floors, furniture and fittings in the office premises had been done. A special cleanliness drive was arranged in the areas of residential premises, apartments, hostels, and dispensary, and guest house. A central-ized garbage collection and disposal system was installed in those areas. Pest control and fogging operation for control of mosquito around residential and non-residential buildings, open area of the premises was done.
Swachh Paryavaran	Carried out cleaning activities (both in office and residential areas) and installation of potted plants in the office corridors to create an eco-friendly environment. Plantation of saplings and arrangements for rainwater harvesting system were made.
Swaachh Anubhaag	Unused/old files/records/registers had been disposed off as per the record retention schedule. Old magazines and other materials with outdated/least value from the library had been weeded out. Furniture and fittings with an unserviceable condition or obsolete had been removed.
Swachh Neer	Intensive inspection/checking and upkeeping drive for all water installa-tions including water filter plants, sources of water supply, water taps for drinking water at the office, residential colonies, hostels, hospitals, schools, etc. were carried out.
Swachh Prasadhan	Removed seepages and renovated damaged constructions, broken pipelines, toilets, washrooms and drainage system.
Swachh Ahar	Carried out the intensive cleaning of office canteen, hostel kitchen, etc., and ensured for clean and hygiene in the canteen.
Swachh Karyalay	Cleaned the office premises and adjoining areas.
Pratispardha	Created awareness by making the exhibition and conducted various competitions such as quiz, debate, and essay writing on 'cleanliness and hygiene'.
Review and closing cere-mony	Reviewed the entire swachhta pakwada campaign and the closing function was held on november 15, 2017. The entire activities and details with photographs and videos published in our website and simultaneously the detailed report had been sent to the csir. During the closing function, the winners of various competitions were given certificates and prizes.
Swachh Neelaami	Auctioned the obsolete/unserviceable office items.



Carrying out cleaning work in the campus

INDEPENDENCE DAY

Celebrating our nation's 71st Independence Day, Dr. Vijayamohanan K. Pillai, Director, CSIR-CECRI, hoisted the National Flag at 8.05 a.m. at CSIR-CECRI. In his address, Dr. Vijayamohanan K. Pillai recalled the patriots who shed blood and sacrificed their lives in bringing freedom for our nation. He highlighted the remarkable scientific achievements and accomplishments made by our great scientists since our nation's independence. He mentioned about the efforts taken by our visionary leaders and scientists in establishing scientific laboratories like CSIR over the years. He stressed the importance of doing science towards the societal benefits and development. After hoisting the National Flag at CSIR-CECRI, the Director, CSIR-CECRI hoisted the National Flag at Kendriya Vidyalaya and Sishu Vidyalaya and delivered his motivational speech to the students.



Dr. Vijayamohanan K Pillai, Director hoisting the National flag

HEALTH CENTRE

The Health Centre is located in the vicinity of the campus. It serves the medical and emergency needs of staff and their dependent family members, students, research scholars and project assistants. The Centre functions on all working days except Sunday and closed holidays. The consulting timings for outpatients (OP) are 08:00-11:00 and 16:00-19:00 hrs on all weekdays and 08:00-10:30 hrs on Saturday. A resident full-time medical officer and a team of healthcare professionals are dedicated for emergency needs of staff and their dependent family members. On an average, 50 patients per day are getting treated in the health centre.

Equipment and Facility

- New medical equipment facility comprises of GE Emergency Monitor, Fully Automatic Analyzer, Electrolyte Analyzer, and Laser equipment for physiotherapy were declared open by Padma Vibhushan Dr. Anil Kakodkar on July 25, 2017.
- The health centre has a separate pharmacy section and air-conditioned drug store to keep the drugs under the room temperature below 26 °C.
- The hospital management software was installed in the health centre and it was inaugurated by Shri K. R. Vaidheeswaran, Joint Secretary (A) CSIR, New Delhi on May 25, 2017. The successful installation of hospital management software helps to track the medical record of patients and managing the stock of drugs available in the pharmacy.
- CSIR-CECRI ambulance was revamped with a mobile stretcher (for shifting the patient), passenger seat, doctor seat, oxygen supply point, storage boxes, wash basin and other facilities.



Shri. K.R. Vaidheeswaran, Joint Secretary (A) CSIR inaugurating hospital management software.

Oral Polio Camp

Under the immunization programme of Health and Family Welfare Department, Tamil Nadu, CSIR-CECRI health centre by joining hands with the state government, conducted Oral Polio camps in our health centre on April 02, 2017 and April 30, 2017. Through these camps, 70 children having >5 years of age obtained immunization.

REPUBLIC DAY

Celebrating the occasion of our nation's 69th Republic Day on January 26, 2018, Dr. Vijayamohnan K. Pillai, Director, CSIR-CECRI hoisted the National Flag at CSIR-CECRI. He hoisted the national flag at Kendriya Vidyalaya and Sishu Vidyalaya. As part of the Republic Day celebrations, CSIR-CECRI Club conducted various competitions for the wards of CSIR-CECRI and the prizes were distributed to the



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VIGILANCE AWARENESS WEEK – 2017

Under the instructions of Central Vigilance Commission and Chief Vigilance Officer, CSIR, New Delhi, CECRI observed Vigilance Awareness week from October 30, 2017 to November 03, 2017. The observance commenced with taking the pledge by CSIR-CECRI staff and created awareness by displaying posters and conducting slogan competition.





CECRI LADIES FORUM (CLF)

Lectures and Interaction

Dr. Caroline Nesabai, Head, Dept. of Social Science and Director, Centre for Women Studies, Lady Doak College, Madurai visited CSIR-CECRI and interacted with CLF members on November 03, 2017. She addressed various issues related to women.



The interaction between CLF members and Dr. Caroline Nesabai

Science Awareness Programme for Rural School Children

A Science Awareness Programme for Rural School Children of class VI to Xth standard was organized and conducted by CLF members on March 05, 2018 at CSIR-CECRI. About 150 students and teachers from 12 different schools participated in this event. Several competitions such as elocution, science quiz, science exhibits were conducted. Winners were honoured with prizes and medals during this celebration.







Science awareness programme and students participating in various events

CSIR-CECRI Creche Facility

CLF has restarted the creche facility for the wards of CSIR-CECRI family members. Mrs. Manju Vijayamohanan K. Pillai, Chief Guest of the function graced the occasion and inaugurated the facility on January 25, 2018.



Inauguration of Crèche facility for the wards of CSIR-CECRI members

RESEARCH PUBLICATIONS

No.	Publications	IF-2017
1	Laskowski, FAL; Nellist, MR; Venkatkarthick, R; Boettcher, SW., Junction behavior of n-Si photoanodes protected by thin Ni elucidated from dual working electrode photoelectrochemistry, *Energy Environ. Sci.,* 10, 570-579 (2017)	30.067
2	Krishnan, K; Muruganathan, M; Tsuruoka, T; Mizuta, H; Aono, M., Highly Reproducible and Regulated Conductance Quantization in a Polymer-Based Atomic Switch, *Adv. Funct. Mater.,* 27, 1605104 (2017)	13.325
3	Anantharaj, S; Karthick, K; Venkatesh, M; Simha, TVSV; Salunke, AS; Ma, L; Liang, H; Kundu, S., Enhancing electrocatalytic total water splitting at few layer Pt-NiFe layered double hydroxide interfaces, *Nano Energy,* 39, 30-43 (2017)	13.12
4	Mathankumar, M; Anantharaj, S; Nandakumar, AK; Kundu, S; Subramanian, B., Potentiostatic phase formation of beta-CoOOH on pulsed laser deposited biphasic cobalt oxide thin film for enhanced oxygen evolution, *J. Mater. Chem. A,* 5, 23053-23066 (2017)	9.931
5	Nayak, P; Jiang, Q; Kurra, N; Wang, XB; Buttner, U; Alshareef, HN., Monolithic laser scribed graphene scaffolds with atomic layer deposited platinum for the hydrogen evolution reaction, *J. Mater. Chem. A,* 5, 20422-20427 (2017)	9.931
6	Roh, HK; Kim, MS; Chung, KY; Ulaganathan, M; Aravindan, V; Madhavi, S; Roh, KC; Kim, KB., A chemically bonded $NaTi_2(PO_4)_3$/rGO microsphere composite as a high-rate insertion anode for sodium-ion capacitors, *J. Mater. Chem. A,* 5, 17506-17516 (2017)	9.931
7	Gorle, DB; Kulandainathan, MA., One-pot synthesis of highly efficient graphene based three-dimensional hybrids as catalyst supporting materials for electro-oxidation of liquid fuels, *J. Mater. Chem. A,* 5, 15273-15286 (2017)	9.931
8	Vadivelu, M; Sugirdha, S; Dheenkumar, P; Arun, Y; Karthikeyan, K; Praveen, C., Solvent-free implementation of two dissimilar reactions using recyclable CuO nanoparticles under ball-milling conditions: synthesis of new oxindole-triazole pharmacophores, *Green Chem.,* 19, 3601-3610 (2017)	8.586
9	Selvamani, V; Gopi, S; Rajagopal, V; Kathiresan, M; Vembu, S; Velayutham, D; Gopukumar, S., High Rate Performing in Situ Nitrogen Enriched Spherical Carbon Particles for Li/Na-Ion Cells, *ACS Appl. Mater. Interfaces,* 9, 39326-39335 (2017)	8.097
10	Kundu, S; Malik, B; Pattanayak, DK; Pillai, VK., Effect of Dimensionality and Doping in Quasi-"One-Dimensional (1-D)" Nitrogen-Doped Graphene Nanoribbons on the Oxygen Reduction Reaction, *ACS Appl. Mater. Interfaces,* 9, 38409-38418 (2017)	8.097
11	Kalimuthu, B; Nallathamby, K., Designed Formulation of Se-Impregnated N-Containing Hollow Core Mesoporous Shell Carbon Spheres: Multifunctional Potential Cathode for Li-Se and Na-Se Batteries, *ACS Appl. Mater. Interfaces,* 9, 26756-26770 (2017)	8.097
12	Maruthapandian, V; Mathankumar, M; Saraswathy, V; Subramanian, B; Muralidharan, S., Study of the Oxygen Evolution Reaction Catalytic Behavior of $Co_xNi_{1-x}Fe_2O_4$ in Alkaline Medium, *ACS Appl. Mater. Interfaces,* 9, 13132-13141 (2017)	8.097

No.	Publications	IF-2017
13	Anantharaj, S; Kennedy, J; Kundu, S., Microwave-Initiated Facile Formation of Ni_3Se_4 Nanoassemblies for Enhanced and Stable Water Splitting in Neutral and Alkaline Media, *ACS Appl. Mater. Interfaces,* 9, 8714-8728 (2017)	8.097
14	Jayakumar, M; Hemalatha, K; Chander, AA; Sahu, AK; Prakash, AS., Origin of charge storage in cobalt oxide - Anchored graphene nanocomposites, *Carbon,* 125, 168-179 (2017)	7.082
15	Arunchander, A; Peera, SG; Panda, SK; Chellammal, S; Sahu, AK., Simultaneous co-doping of N and S by a facile in-situ polymerization of 6-N, N-dibutylamine-1,3,5-triazine-2,4-dithiol on graphene framework: An efficient and durable oxygen reduction catalyst in alkaline medium, *Carbon,* 118, 531-544 (2017)	7.082
16	Rana, M; Subramani, K; Sathish, M; Gautam, UK., Soya derived heteroatom doped carbon as a promising platform for oxygen reduction, supercapacitor and CO_2 capture, *Carbon,* 114, 679-689 (2017)	7.082
17	Balakumar, K; Kalaiselvi, N., Selenium containing Tube-in-Tube carbon: A one dimensional carbon frame work for selenium cathode in Li-Se battery, *Carbon,* 112, 79-90 (2017)	7.082
18	Karuppiah, S; Nallathamby, K., Reaping the redox switching capability of vanadium in $Li_3V_2(PO_4)_3$/HHC composite to demonstrate the rocking chair electrode performance, *J. Power Sources,* 366, 207-217 (2017)	6.945
19	Maharjan, M; Bhattarai, A; Ulaganathan, M; Wai, N; Oo, MO; Wang, JY; Lim, TM., High surface area bio-waste based carbon as a superior electrode for vanadium redox flow battery, *J. Power Sources,* 362, 50-56 (2017)	6.945
20	Arunchander, A; Peera, SG; Sahu, AK., Synthesis of flower-like molybdenum sulfide/graphene hybrid as an efficient oxygen reduction electrocatalyst for anion exchange membrane fuel cells, *J. Power Sources,* 353, 104-114 (2017)	6.945
21	Pavithra, N; Velayutham, D; Sorrentino, A; Anandan, S., Thiourea incorporated poly(ethylene oxide) as transparent gel polymer electrolyte for dye sensitized solar cell applications, *J. Power Sources,* 353, 245-253 (2017)	6.945
22	Duraisamy, E; Gurunathan, P; Das, HT; Ramesha, K; Elumalai, P., [Co(salen)] derived Co/Co_3O_4 nanoparticle@carbon matrix as high-performance electrode for energy storage applications, *J. Power Sources,* 344, 103-110 (2017)	6.945
23	Christy, M; Arul, A; Zahoor, A; Moon, KU; Oh, MY; Stephan, AM; Nahm, KS., Role of solvents on the oxygen reduction and evolution of rechargeable Li-O_2battery, *J. Power Sources,* 342, 825-835 (2017)	6.945
24	Karuppiah, S; Vellingiri, S; Nallathamby, K., Newer polyanionic bio-composite anode for sodium ion batteries, *J. Power Sources,* 340, 401-410 (2017)	6.945
25	Reddy, NL; Kumar, S; Krishnan, V; Sathish, M; Shankar, MV., Multifunctional Cu/Ag quantum dots on TiO_2 nanotubes as highly efficient photocatalysts for enhanced solar hydrogen evolution, *J. Catal.,* 350, 226-239 (2017)	6.759

No.	Publications	IF-2017
26	Parthiban, V; Akula, S; Sahu, AK., Surfactant templated nanoporous carbon-Nafion hybrid membranes for direct methanol fuel cells with reduced methanol crossover, *J. Membr. Sci.,* 541, 127-136 (2017)	6.578
27	Mahto, A; Gupta, R; Ghara, KK; Srivastava, DN; Maiti, P; Kalpana, D; Rivera, PZ; Meena, R; Nataraj, SK., Development of high-performance supercapacitor electrode derived from sugar industry spent wash waste, *J. Hazard. Mater.,* 340, 189-201 (2017)	6.434
28	Kundu, S; Malik, B; Prabhakaran, A; Pattanayak, DK; Pillai, VK., Topotactic transition of alpha-$Co(OH)_2$ to beta-$Co(OH)_2$ anchored on CoO nanoparticles during electrochemical water oxidation: synergistic electrocatalytic effects, *Chem. Commun.,* 53, 9809-9812 (2017)	6.29
29	Ahad, SA; Ragupathy, P; Ryu, S; Lee, HW; Kim, DK., Unveiling the synergistic effect of polysulfide additive and MnO_2 hollow spheres in evolving a stable cyclic performance in Li-S batteries, *Chem. Commun.,* 53, 8782-8785 (2017)	6.29
30	Moni, P; Hyun, S; Vignesh, A; Shanmugam, S., Chrysanthemum flower-like $NiCo_2O_4$-nitrogen doped graphene oxide composite: an efficient electrocatalyst for lithium-oxygen and zinc-air batteries, *Chem. Commun.,* 53, 7836-7839 (2017)	6.29
31	Raju, CV; Kumar, SS., Highly sensitive novel cathodic electrochemi-luminescence of tris(2,2 '-bipyridine) ruthenium(II) using glutathione as a co-reactant, *Chem. Commun.,* 53, 6593-6596 (2017)	6.29
32	Prataap, RKV; Mohan, S., Electrodeposited-hydroxide surface-covered porous nickel-cobalt alloy electrodes for efficient oxygen evolution reaction, *Chem. Commun.,* 53, 3365-3368 (2017)	6.29
33	Thangasamy, P; Ilayaraja, N; Jeyakumar, D; Sathish, M., Electrochemical cycling and beyond: unrevealed activation of MoO_3 for electrochemical hydrogen evolution reactions, *Chem. Commun.,* 53, 2245-2248 (2017)	6.29
34	Anantharaj, S; Venkatesh, M; Salunke, AS; Simha, TVSV; Prabu, V; Kundu, S., High-Performance Oxygen Evolution Anode from Stainless Steel via Controlled Surface Oxidation and Cr Removal, *ACS Sustain. Chem. Eng.,* 5, 10072-10083 (2017)	6.14
35	Kundu, S; Ma, L; Dai, W; Chen, YY; Sinyukov, AM; Liang, H., Polymer Encapsulated Self-Assemblies of Ultrasmall Rhenium Nanoparticles: Catalysis and SERS Applications, *ACS Sustain. Chem. Eng.,* 5, 10186-10198 (2017)	6.14
36	Vahidhabanu, S; Idowu, AA; Karuppasamy, D; Babu, BR; Vineetha, M., Microwave Initiated Facile Formation of Sepiolite-Poly(dimethylsiloxane) Nanohybrid for Effective Removal of Congo Red Dye from Aqueous Solution, *ACS Sustain. Chem. Eng.,* 5, 10361-10370 (2017)	6.14
37	Ramakrishnan, K; Nithya, C; Purushothaman, BK; Kumar, N; Gopukumar, S., Sb_2O_4@rGO Nanocomposite Anode for High Performance Sodium-Ion Batteries, *ACS Sustain. Chem. Eng.,* 5, 5090-5098 (2017)	6.14
38	Mishra, A; Ulaganathan, M; Edison, E; Borah, P; Mishra, A; Sreejith, S; Madhavi, S; Stuparu, MC., Polymeric Nanomaterials Based on the Buckybowl Motif: Synthesis through Ring-Opening Metathesis Polymerization and Energy Storage Applications, *ACS Macro Lett.,* 6, 1212-1216 (2017)	6.131

No.	Publications	IF-2017
39	Sakthikumar, K; Anantharaj, S; Ede, SR; Karthick, K; Ravi, G; Karthik, T; Kundu, S., Prompt synthesis of iridium organosol on DNA for catalysis and SERS applications, *J. Mater. Chem. C,* 5, 11947-11957 (2017)	5.976
40	Kundu, S; Chen, YY; Dai, W; Ma, L; Sinyukov, AM; Liang, H., Enhanced catalytic and SERS activities of size-selective Rh NPs on DNA scaffolds, *J. Mater. Chem. C,* 5, 2577-2590 (2017)	5.976
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241	Senthil Kumar, SM; Selvakumar, K; Karthikeyan, J; Thangamuthu, R; Murugan, P; Rajput, P; Jha, SN; Bhattacharyya, D; Navascues, N; Irusta, S., Manifestation of Concealed Defects in MoS_2 Nanospheres for Efficient and Durable Electrocatalytic Hydrogen Evolution Reaction, *ChemistrySelect,* 2, 4667-4672 (2017)	1.505
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No.	Publications	IF-2017
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No.	Publications	IF-2017
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272	Gurunathan P., Ette P.M., Lakshminarasimhan N., Ramesha K.., A Convenient Synthesis Route for Co_3O_4 Hollow Microspheres and Their Application as a High Performing Anode in Li-Ion Batteries, *Acs Omega,* 2, 7647-7657 (2017)	NA
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MANPOWER POSITION (As on March 31, 2018)

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Dr. Vijayamohanan K Pillai

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129	Smt. Panjali Natarajan
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174	Shri. M. Vadivel
175	Shri. V. Prabu

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231	Smt. G. Bharathi Priya
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234	Shri. S. Sukumar
235	Shri. M. Pradeeban
236	Shri. J. Marimuthu

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237	Shri. R. Nagarajan
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240	Shri. RM. Raghu
241	Shri. M. Senthil Kumar
242	Shri. K. Kumaravelu
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244	Shri. S. Gopalakrishnan
245	Shri. M. Nagarajan
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247	Smt. C. Pothumponnu
248	Shri. C. Seetharaman
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249	Smt. Vinutha Ramani
250	Shri. A. Gopu
251	Shri. T. Rajarathinam
252	Shri. K. Babu
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259	Shri. Y. Nagoor Gani
260	Smt. R. Banumathi
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262	Shri. P. Karuppiah
263	Shri. K. Sivaraman
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269	Smt. C. Ramya
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272	Ms. Binsha.P
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275	Shri. S. Raju
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276	Shri. A. Ganeshan
277	Shri. A. Deenadayalan
Assistant Section Officers (F&A)	
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279	Shri. A. Chinnaiah
280	Shri. S. Ramakrishnan
281	Shri. K. Venkatesan
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283	Shri. J. Sreenu Sivakumar
284	Shri. M. Esakimuthu
Junior Secretariat Assistant (F&A)	
285	Smt. N. Sornalatha
Stores and Purchase Officer	
286	Shri. K.P.S. Ganapathy
Assistant Section Officers (S&P)	
287	Shri. V. Elumalai
288	Shri. C. Subramanian

Sl. No	Name of the Staff
289	Shri. R. Rajagopal
Senior Secretariat Assistants (S&P)	
290	Shri. P. Lakshmanan
291	Smt. M. Suseela
Private Secretaries	
292	Shri. A.R. Kumaran
293	Shri. I. Sakthivel
294	Shri. M. Nehru Pandiaraj
Senior Stenographers	
295	Smt. Jayanthi Thangamani
296	Smt. P. Saraswathi
297	Shri. K. Srinivasan
298	Smt . M. Latha
299	Shri. NS. Radhakrishnan
300	Smt. M. Nageswari
301	Smt. T. Chithradevi
302	Smt. M. Indudevi @ Deivanai
303	Smt. R.M. Vijayalakshmi
304	Smt. D. Umarani
Junior Stenographer	
305	Shri. M. Karthi
Security Officer	
306	Shri. L. Thomas Alexander

Sl. No	Name of the Staff
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307	Shri. K. Meyyappan
Senior Hindi Officer	
308	Shri. K.R. Kumaresh Bapu
Hindi Officer	
309	Shri. Someshwar Pandeya
Junior Hindi Translator	
310	Smt. G. Kalaivani
Multi Tasking Staff	
311	Smt. S. Pappa
312	Smt. M. Valli
Counter Clerk	
313	Shri. P. Manoharan
Bearers	
314	Shri. A. Selvam Sethupathy
315	Shri. E. Deva Asirvatham
316	Shri. M. Gnanaprakash
317	Shri. P. Murugiah
318	Shri. V. Mohandass
Driver	
319	Shri. S. Balamurali
Technician(2) [Female Nursing Assistant]	
320	Smt. T. Geetha
Technician(2) [Lab Technician(clinical)]	
321	Shri. R. Venkatesh

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Shri. G. Anand Babu


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Dr. R. Sindhuja


Dr. Dhavale Vishal Mahesh

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Senior scientist
Transferred from CSIR-NIO, Goa



Dr. S. Sudhakar
Scientist
Transferred from CSIR-NPL, New Delhi



Dr. Kuldeep Singh
Scientist
Transferred to CSIR-NPL, New Delhi



Dr. Sailaja Krishnamurthy
Principal Scientist
Transferred to CSIR-NCL, Pune



Shri. Anand Bharti
Section Officer (S&P)
Transferred to CSIR-NML, Jamshedpur



Dr. S.S. Sreeja Kumari
Scientist
Transferred to CSIR-NIIST, Trivandrum



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Dr. G.N.K. Ramesh Bapu


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Dr. S. Muralidharan


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