CSIR-CECRI

वार्षिक प्रतिवेदन
2013 - 2014
ANNUAL REPORT

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

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July 25, 1948: Pandit Jawaharlal Nehru, Prime Minister, Republic of India, on the occasion of laying the foundation stone of the institute.

PREAMBLE

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From the Director's Desk

Annual reports showcase an organization's achievements in the year gone by. They reflect the sweet sweat of its employees and camouflage their shortcomings. They are also course markers that trace our proud past with subtle pointers to the future. A relentless focus on innovation over the year that was has helped us to deliver strong numbers in terms of external cash flow, patents, high-impact publications and PhD registrants. For example, over the past year the external cash flow was 5% more than that in the previous year; similarly, the total number of papers rose from 160 to 171, with the average impact factor jumping from 1.8 to 3.1 despite a reduction in the sanctioned Group IV strength from 180 to 120.

While it was business as usual on the research front, it was business unusual as far as our visibility was concerned. We bagged another CSIR Young Scientist award last year. In fact, at the time of writing this report, we had already made a hat-trick of Young Scientist Awards. That is indication enough that we are on a stronger footing than ever before, which must be sustained in the years ahead. I am sure we will continually assess our priorities, re-work on research models and take positive action to rebuild our reputation. The fruits of success are for all, including the bottom-rung colleagues whose toil often goes unnoticed and unrecognized. We believe that our research efforts underpin our responsibility to this great country in as much as it drives our decisions to achieve our strategic goals.

At CSIR-CECRI, we do not rest on laurels; instead, we live up to it and look beyond. With this outlook, I am delighted to present the annual report of this institute for the year 2013–2014.

Vijayamohanan K Pillai

निदेशक की कलम से

वार्षिक प्रतिवेदन सदैव सम्बद्ध संगठन की गत एक वर्ष की उपलब्धियों को प्रदर्शित करते हैं। ये प्रतिवेदन उस संगठन के कर्मचारियों के कठिन परिश्रम को उभारते हैं तथा उनकी कमियों को गुप्त रखते हैं। ये ऐसे मार्ग सूचक हैं जो हमारे गौरवशाली इतिहास का अनुगमन करते हुए, सूक्ष्मता से भविष्य की ओर संकेत करते हैं। वर्ष भर नवप्रवर्तन पर अनवरत एकाग्रता ने बाह्य धनापूर्ति, पेटेंट की संख्या, उच्च प्रभाव वाले प्रकाशनों की संख्या तथा पीएचडी छात्रों की संख्या संबंधी बहुत ही अच्छे परिणाम दिये हैं । उदाहरण के लिए इस एक वर्ष की बाह्य.धनापूर्ति पहले की तुलना में 5 प्रतिशत अधिक थी, इसी प्रकार इस वर्ष प्रकाशनों की संख्या 160 से बढ़ कर 171 हो गई तथा इनके प्रभाव गुणक में भी वृद्धि हुई और यह 1.8 से बढ़कर 3.1 पहुंच गया और यह सब ऐसे समय में हुआ जबकि हमारे वैज्ञानिकों की कुल संख्या 180 से घटकर 120 रह गई थी।

यद्यपि अनुसंधान संबंधी कार्य हमेशा की तरह ही था, परंतु हमारी लक्ष्यता के संबंध में यह असाधारण था। गत वर्ष, हमें एक और सीएसआईआर–युवा वैज्ञानिक पुरस्कार प्राप्त हुआ। वास्तव में, इस रिपोर्ट के लिखे जाने तक हम लगातार तीसरी बार – युवा वैज्ञानिक पुरस्कार जीत चुके हैं। यह स्पष्टतः प्रमाणित करता है कि हम पहले की अपेक्षा, अधिक बेहतर स्थिति में हैं और हमें, आने वाले वर्षों में इसे अनवरत बनाए रखना है। मुझे पूर्ण विश्वास है कि हम हमारी प्राथमिकताओं का निरंतर मूल्यांकन करते रहेंगे, अनुसंधान प्रतिरूपों पर पुनः कार्य करेंगे एवं नए सिरे से अपनी प्रतिष्ठा के निर्माण के लिए सकारात्मक कार्रवाई करेंगे। सफलता का श्रेय सबके लिए है, प्रत्येक छोटे से छोटा सहयोगी, जिसका परिश्रम अक्सर अदृष्ट तथा अलक्षित रह जाता है, वह भी इसका सहभागी है। हम यह मानते हैं कि हमारे अनुसंधानात्मक प्रयास जहां एक ओर इस महान राष्ट्र के प्रति हमारे दायित्व को आधार देते हैं, वहीं दूसरी ओर ये हमारे सामरिक महत्व के लक्ष्यों की प्राप्ति संबंधी हमारे निर्णयों को संचालित भी करते हैं ।

सीएसआईआर–सीईसीआरआई में, हम अतीत में मिले सम्मान पर आश्रित नहीं होते; बल्कि, इस सम्मान के अनुरूप आचरण करते हुए और आगे बढ़ने हेतु सतत प्रयासरत रहते हैं। इसी अपेक्षा के साथ, मैं इस संस्थान की वर्ष 2013 –14 की वार्षिक रिपोर्ट सहर्ष प्रस्तुत करता हूँ ।

विजयमोहनन के पिल्लै

संकल्पना & मिशन / VISION & MISSION

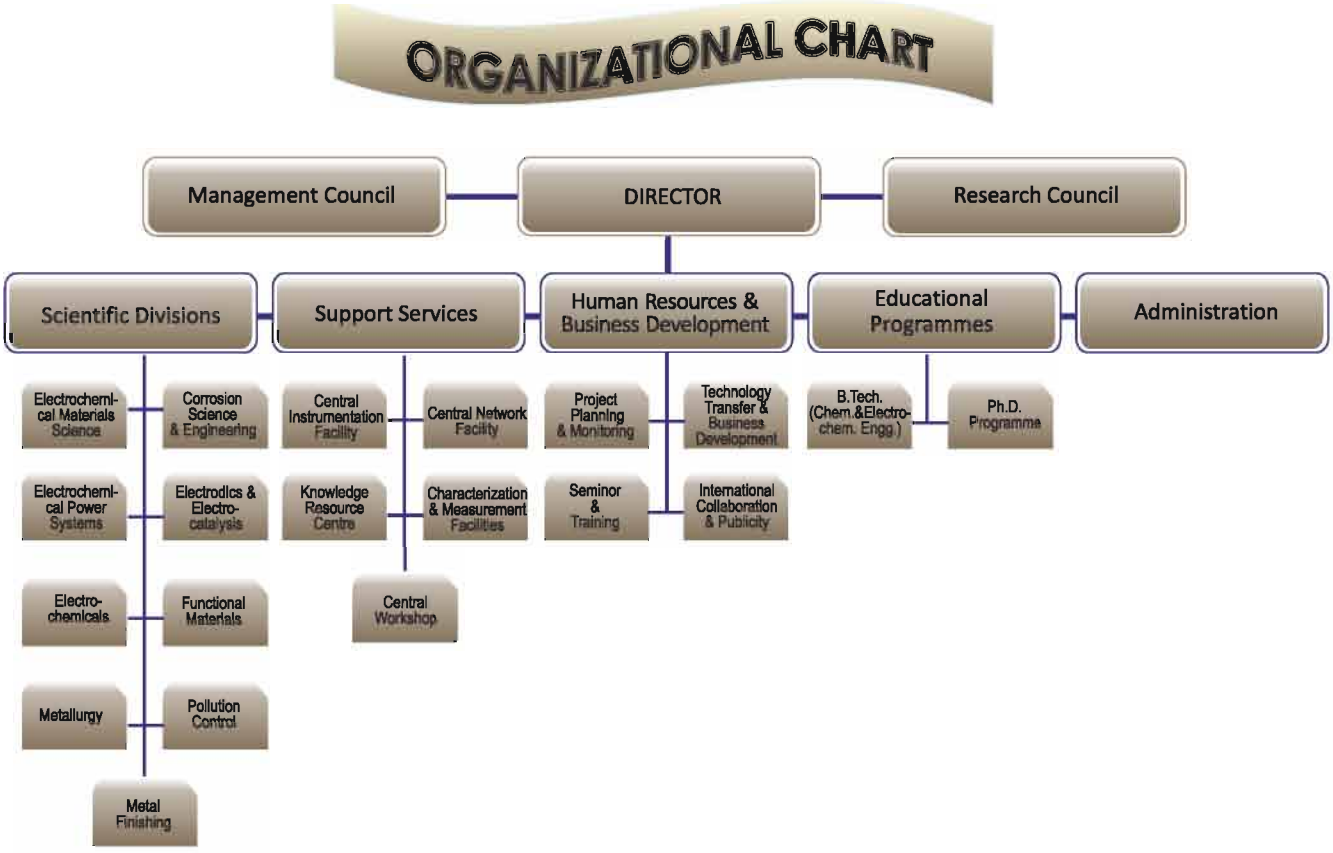
संकल्पना / Vision

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 । To be a leading global R&D centre for electrochemical science and technology through sustained and dedicated efforts focusing on corrossion science and engineering, energy conversion and storage, functional materials and environment.

मिशन / Mission

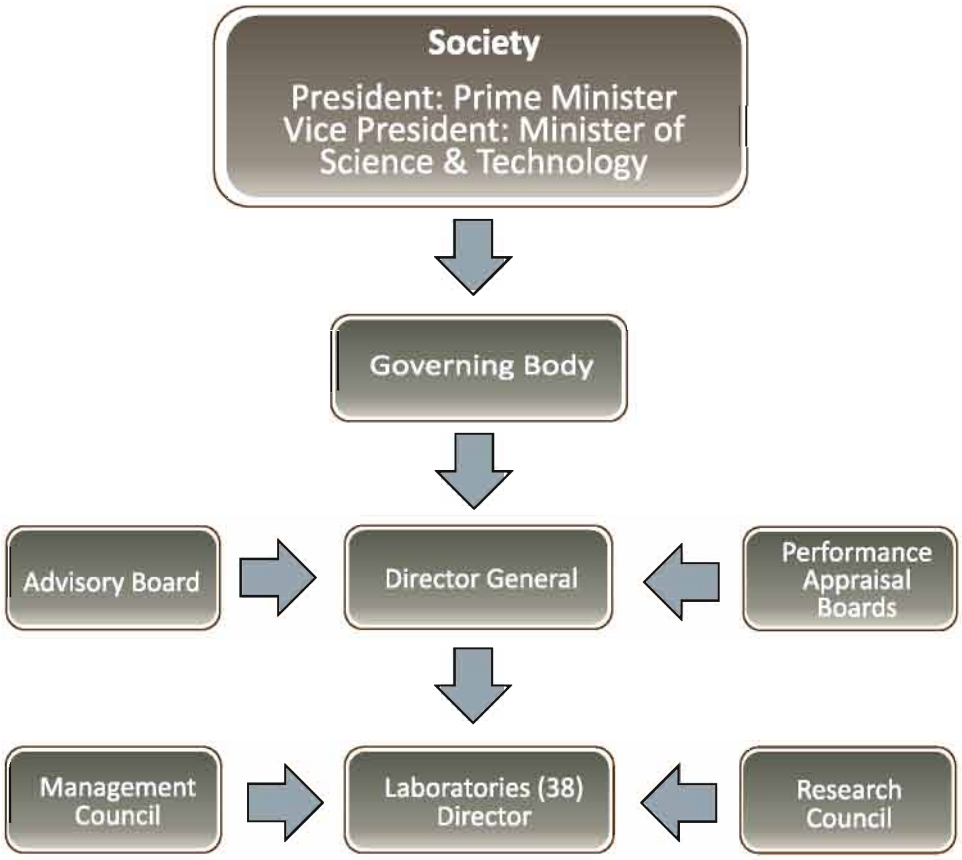
विद्युतरसायन विज्ञान एवं अभियांत्रकी के सभी पहलुओं में अग्रणी होना तथा सामाजिक लाभ के लिए ऊर्जा, पर्यावरण,स्वास्थ्य तथा पदार्थ संरक्षण में विश्व स्तरीय प्र तिस्पर्धात्मक और पर्यावरण–अनुकूल प्रैद्योगिकियों का विकास करना ।

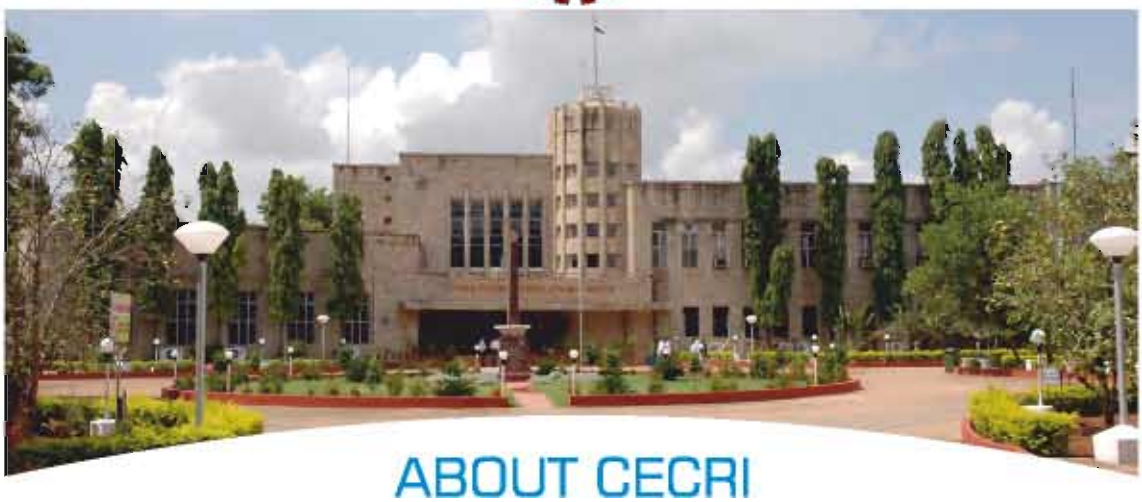
To excel in all aspects of electrochemical science and engineering, and to develop globally competitive and eco-friendly technologies in energy, environment, health and materials conservation for societal benefits.



COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

ORGANIZATIONAL STRUCTURE





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. Shanthi Swarup Bhatnagar. On January 14, 19S3 CECRI became a physical reality when Dr. S. Radhakrishnan dedicated CECRI, the twelfth national laboratory under the CSIR, to the nation. CECRI today is a proud family of 353 employees, 124 of whom are scientists and other subordinates including administration 236. It represents the largest research establishment for electrochemistry in South Asia. Headquartered at Karaikudi, CECRI has extension centers at Chennai, Mandapam and Tuticorin. Located at latitude of 10.06° and longitude of 78.8°, CECRI Karaikudi is about 90 km away both from Trichy and Madurai. The ambience at CECRI is quite apt for R&D work. CECRI campus has a unique bird life and is ample green and serene.

In his address on the occasion of laying the foundation stone of the institute, Pandit Nehru said, "... I believe that by such undertakings and by yoking science to public good we can advance the 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. 1S 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 Electrochemistry, Electrochemical Power Sources, Electrochemical Pollution Control, Electrochemicals, Electrodics and Electrocatalysis, Electrometallurgy, Industrial Metal Finishing, and Computer Networking and Instrumentation. The institute provides a single and unique canopy under which all aspects of electrochemistry and related areas are researched upon in all their dimensions. CECRI's activities are directed towards development of new and improved products and processes as well as innovations in electrochemical science and technology. CECRI runs several projects in collaboration with laboratories from 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)'s PhD programme introduced by CSIR . Researchers from this part of the country make good use of the 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.

To say that the CECRI is the mainstay of electrochemical industry in India is to state the obvious.

सीएसआईआर –सीईसीआरआई

केंद्रीय विद्युतरसायन अनुसंधान संस्थान (सीईसीआरआई) की स्थापना वर्ष 1948 में हुई । इसकी संकल्पना डॉ. आर एम अलगप्पा चेट्टियारए पंडित जवहरलाल नेहरू एवं डॉ. शांति स्वरूप भटनागर की राष्ट्रभक्ति एवं राष्ट्र के विकास की भावना की परिचायक है । डॉ. एस. राधाकृष्णन ने 14 जनवरी 1953 को सीएसआईआर की इस 12वीं राष्ट्रीय प्रयोगशाला को राष्ट्र को समर्पित कर इस संकल्पना को साकार किया । आज सीईसीआरआई 353 कर्मचारियों का एक गौरवमयी परिवार है, जिनमें 124 वैज्ञानिक तथा 236 प्रशासनिक एवं अन्य सहयोगी कर्मचारी हैं । कारैकुडी में स्थित यह संस्थान दक्षिण एशिया का सबसे बड़ा विद्युतरसायन अनुसंधान संस्थान है । सीईसीआरआई के चेन्नै, मण्डपम तथा तूतीकोरिन में विस्तार केंद्र हैं । 10.06 डिग्री अक्षांश तथा 78.8 रेखांश पर स्थित सीईसीआरआई, कारैकुडी – मदुरै और तिरुची दोनों शहरों से लगभग 90 कि.मी. की दूरी पर है । सीईसीआरआई का वातावरण अनुसंधान . कार्यों के लिए पूर्णतः अनुकूल है । सीईसीआरआई – परिसर अत्याधिक हरा–भरा ए शांत और अनोखे पक्षियों से पूर्ण है ।

पंडित जवाहरलाल नेहरू ने संस्थान की स्थापना के दौरान आयोजित समारोह में अपने अभिभाषण में कहा था कि भमेरा यह विश्वास है कि ऐसी स्थापनाओं एवं विज्ञान को जनहित से जोड़ने से अधिकाधिक लोग प्रगति की ओर अग्रसर होंगे। उनके इन शब्दों को यथार्थ में बदलते हुए सीईसीआरआई – भारतीय विद्युतरसायन उद्योग में बहुमुखी प्रौद्योगिकियों के अवतरण मंच के रूप में उभरा है । ऐसे समय में जब विद्युतरसायन को विश्वविद्यालयों में भौतिक रसायन पाठ्यक्रम में दूसरे दर्जे पर रखा जाता था, यह डॉ.अलगप्पा चेट्टियार की लोक दृ कल्याण की भावना एवं दूरदर्शिता ही थी, कि उन्होंने विशेष रुप से 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 ।

अपनी स्थापना 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 नैनोस्तरीय विद्युतरसायन, विद्युतरसायन ऊर्जा स्रोत, विद्युतरसासन प्रदूषण नियंत्रण, विद्युतरसायन, इलैक्ट्रॉडिक्स तथा इलैक्ट्रोकैटालाइसिस, विद्युत धातु–विज्ञान, औद्योगिक धातु परिष्करण तथा कम्प्यूटर नेटवर्किंग से सम्बंधित क्षेत्रों में कार्यरत है । सभी प्रकार की सुविधाओं से सम्पन्न इस संस्थान में विद्युरसायन के सभी पहलुओं पर शोध कार्य किए जाते है । सीईसीआरआई के सभी अनुसंधान कार्य सदैव विद्युतरसायन विज्ञान तथा प्रौद्योगिकी के क्षेत्र में नए आधुनिक उत्पादों, नई प्रणालियों तथा नवीन पद्धतियों के विकास की ओर केंद्रित होते हैं । भारत में तथा विदेशों में स्थित अन्य प्रयोगशालाओं के साथ मिलकर सीईसीआरआई द्वारा कई परियोजनाओं पर कार्य किया जा रहा है ।

सीईसीआरआई परामर्शीय परियोजनाओं तथा सर्वेक्षणों के माध्यम से भारतीय उद्योग जगत को अपना सहयोग प्रदान करता है । इसके अतिरिक्त यह संस्थान उद्योग तथा शिक्षा क्षेत्र के हितार्थ अल्पकालिक पुनश्चर्या पाठ्यक्रम भी आयोजित करता है । सीईसीआरआई द्वारा मानव संसाधन विकास कार्यक्रम के अंतर्गत सीएसआईआर –वैज्ञानिक तथा अभिनव अनुसंधान अकादमी(एसीएसआईआर) और अन्ना विश्वविद्यालय के रसायन और विद्युत रसायन अभियांत्रिकी पर आधारित बी.टेक पाठ्यक्रम भी चलाए जाते हैं । संस्थान में शोधकर्ताओं के लिए उत्कृष्ट पुस्तकालय सुविधा तथा अत्याधुनिक एवं अभिनव विश्लेषणात्मक और विशिष्ट – सुविधाएं उपलब्ध हैं । सीईसीआरआई, विज्ञान के प्रचार–प्रसार हेतु राष्ट्रीय और अंतर्राष्ट्रीय सम्मेलनों का आयोजन भी करता है । यह संस्थान अपने सामाजिक दायित्वों के प्रति ी जागरूक है तथा इसके अंतर्गत उद्यमी विकास और सीएसआईआर युवा विकास कार्यक्रम आदि में भी सक्रिय है । भारतीय उद्योग के हित में उल्लेखनीय सेवा के लिए सीईसीआरआई को कई प्रौद्योगिकी – सम्मान प्राप्त हुए हैं ।

वास्तव में केंद्रीय विद्युतरसायन अनुसंधान संस्थान भारत में विद्युतरसायन उद्योग का एक प्रमुख आधार है ।

अनुसंधान परिषद
RESEARCH COUNCIL

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Research Council ...

Sl. No.		नाम एवं पता Name and Address
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09.		डॉ विजयमोहनन के. पिल्लै निदेशक केंद्रीय विद्युतरसायन अनुसंधान संस्थान कारैकुडी - 630006 Dr Vijayamohanan K Pillai Director Central Electrochemical Research Institute Karaikudi - 630006

Research Council ...

Sl. No.		नाम एवं पता Name and Address
10.		प्रमुख अथवा उनके नामिति योजना एवं निष्पादन प्रभाग वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद अनुसंधान भवन # 2, रफी मार्ग नई दिल्ली - 110001 Head or his Nominee Planning & Performance Division Council of Scientific & Industrial Research New Delhi - 110001

Sl. No.		नाम एवं पता Name and Address
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प्रबंधन परिषद
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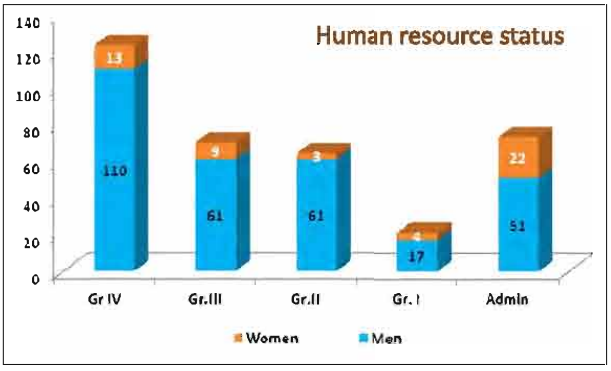
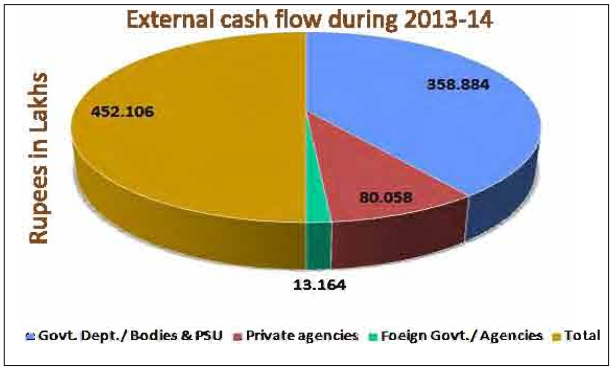
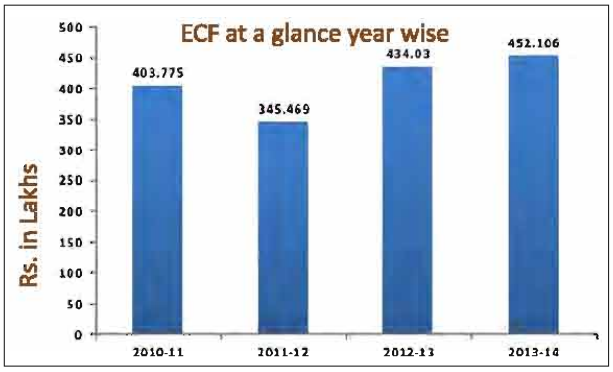
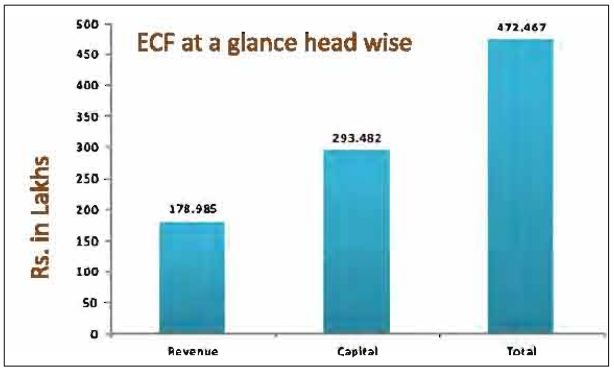
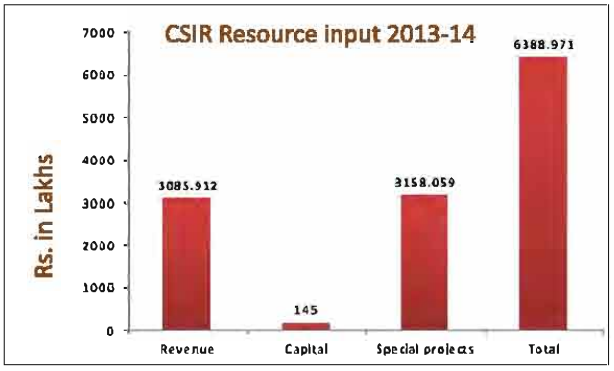
PERFORMANCE INDICATORS

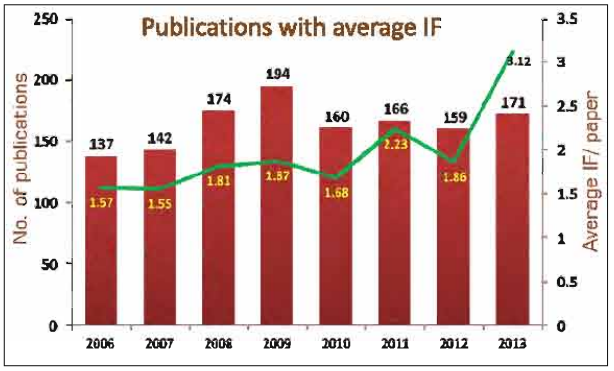


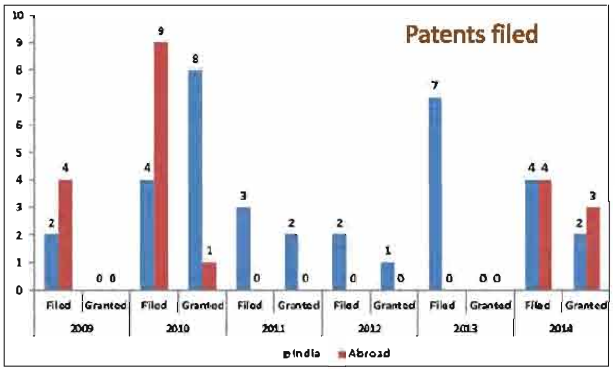


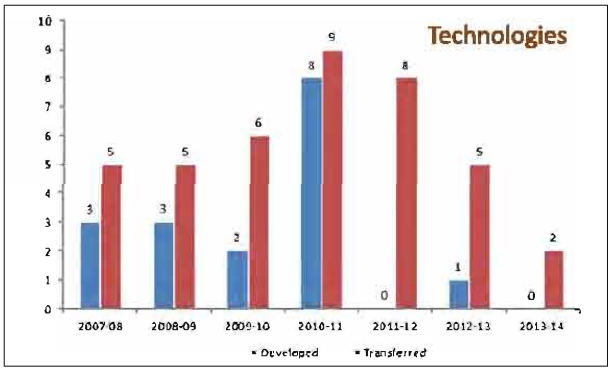












January 14, 1953: Dr. Sarvepalli Radhakrishnan, Vice-President, Republic af India, declaring CECRI open.

CONTENTS

September 19, 1973: Indira Priyadarshini Gandhi, Prime Minister, Republic af India, during her visit to the institute.


CSIR
MAJOR PROJECTS
CECRI

Dynacool PPMS (Quantum Design)

NMITLI PROJECTS

TLP-01/12

Development and commercial production of the NXR-4D: A lithium-ion battery-powered 4-door next-generation electric car (4-seater capacity)

Division involved	: Electrochemical Power Systems and CECRI Chennai Unit (plus Mahindra RVA and CSIR-CMERI)
Nodal Officer	: Er. S. Ambalavanan
Members:	Dr. P. Periasamy, Dr. Alok Paul, Dr. A.S. Prakash, Dr. S. Ramesha, Er. M. Ramakrishnan, Dr. M. Ganesan, Dr. M. Raju and Shri. S. Sekar
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2012 – March 2015
Budget	: Rs 2.42 crore

Objectives

- To develop and demonstrate the world's lightest and lowest cost, 4-door, 4-seater battery-operated electric car and off-board fast charger.

Highlights

- To develop and demonstrate the world's lightest and lowest cost, 4-door, 4-seater battery-operated electric car and off-board fast charger.

MReva Electric car -4W

TLP-02/12

Development and commercialization of Soleckshaw Lite, an innovative electric green transport platform

Division involved	: Electrochemical Power Systems (with Kinetic Engineering and CSIR-CMERI)
Nodal Officer	: Er. S. Ambalavanan
Members:	Er. M. Ramakrishnan, Shri. S. Sekar, Shri. V. Muthumani and Shri. P. Seenichamy
Sponsor	: Council of Scientific and Industrial Research
Duration	: May 2012 – October 2014
Budget	: Rs 23.68 lakh

Objectives

- To design and develop a sustainable and affordable electric three-wheeler for green urban local transport

Highlights

- Life cycle test as per IEC 60254-1:1997 specification is in progress. A 3-D graphical form is prepared to find the safe conditions for operating the vehicle in dynamic condition – state-of-charge, rate of
- Drain, and Drive motor power are analyzed and their inter-relationships have been determined. Vibration tests were carried out as per USABC. Dynamic discharge performance tests were carried out as per IEC 60254–1: 1997. A database for electric vehicle r 4 W, 3 W, 2 W available all over the world was prepared. A tear-down analysis of 3EV 200 Exide battery failed due to cut in the inter-cell connection. An algorithm for fast charging of lead-acid battery was developed

Soleckshaw – 3W

TLP-01/13

Development and demonstration of polymer electrolyte fuel Cell stacks for stationary applications

Division involved : CSIR-Central Electrochemical Research Institute Chennai Unit
Nodal Officer : Dr. Pitchumani
Members : Dr. P. Sridhar, Manokaran
Sponsor : Council of Scientific and Industrial Research
Duration : April 2012 – March 2015
Budget : Rs 603 lakh

Durability test was taken up for 1 kW stack built up with indigenous components but for the polymer electrolyte membrane. This is after the failure analysis of 1 kW stack on account non-uniform thickness of the gasket resulting in uneven compression of the MEA and disruption of the pore size leading to reduced performance. MEAs were tested on a single cell level while ensuring the maximum variation in thickness of the gasket to be within 50 µm. After validating the single cell for its performance in three trials, a 36-cell LT-PEFC stack was assembled and tested for its performance with hydrogen and oxygen and the results are given in Fig. 1 and Fig. 2.

The performance results are also compared with the previously tested 37-cell stack assembly as presented in Figures 3 & 4.

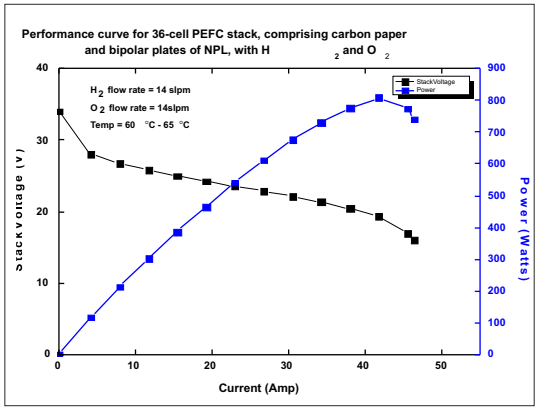


Fig. 1

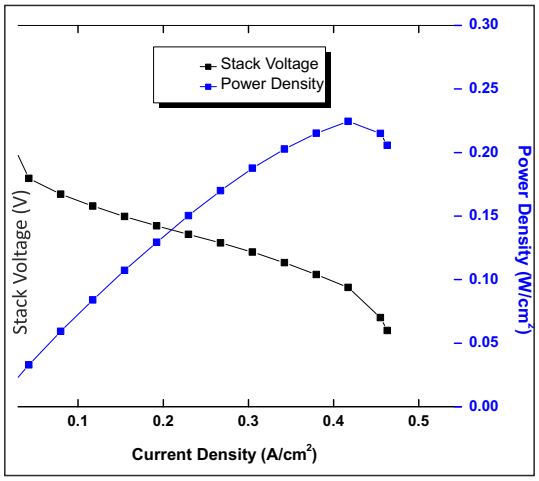


Fig. 2

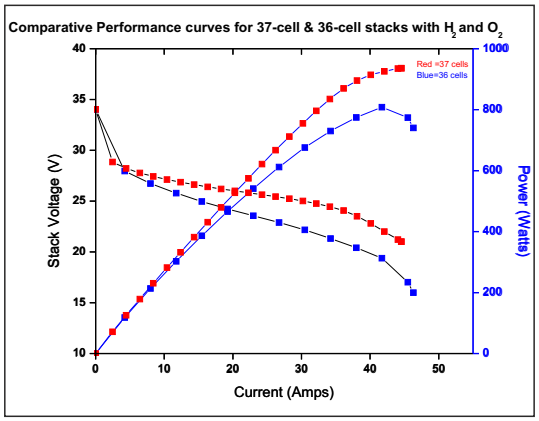


Fig. 3

Stack testing could not be continued with hydrogen and air as some of the cells showed decreased performance. Cross-over of gas through the plate was suspected as the possible cause for decreased performance. A bipolar plate was selected from the stack and a test set up as

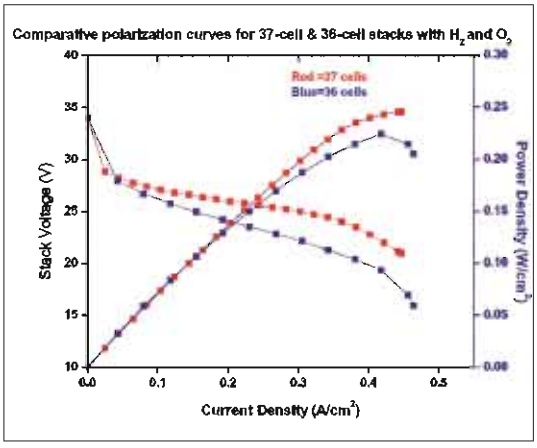


Fig. 4

Fig. 5

shown in Fig. 5 was made to check the gas permeability. Gas permeability was observed when air was passed on side of the bipolar plate at a pressure of 5 psig. The studies confirmed the gas permeability through the bipolar plate. This result was also validated at NCL. Based on the feedback, NPL could resolve the issue and NPL had provided 2mm thick plate for evaluation. Plates of 2 mm thickness was chosen with the assumption that leaving the gas flow field channel depth on both the sides of the plates, the thickness left out is 2 mm. If the plates with thickness 2 mm pass the permeability test NPL will mould 4mm thick graphite plates with the modified procedure. The gas permeability for graphite plates of 2 mm thickness was carried out following the same procedure as explained above. The gas permeability studies carried out for duration of 10 min. showed no air cross over to the other side of the plate similar to Schunk plates. Quantitative evaluation was also carried out using capillary flow porometer. Gas permeability was also carried out for Schunk plates for comparative purpose. The results obtained are given in Fig. 6.

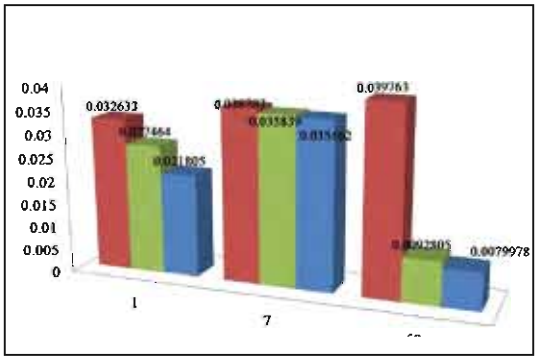


Fig. 6

Bench marking performance of MEA for large area cells

Single cells with an active electrode area of 25 cm^2 were evaluated at ambient and at a pressure of 1 and 2 bar and the results are presented in Fig. 7. Reproducibility studies were also performed and the results are presented in Table 1. Electrochemical impedance spectra were also recorded to ascertain the contribution of contact resistance and the results are presented in Fig. 8. The conductivity values obtained from the ohmic resistance on the abscissa at very high frequency matched with the ionic conductivity values reported for the membrane used in the preparation of MEA confirming that the contact resistance is almost negligible. This is set as a bench mark performance for electrodes of 200 cm^2 area targeted for 3 kW PEFC system.

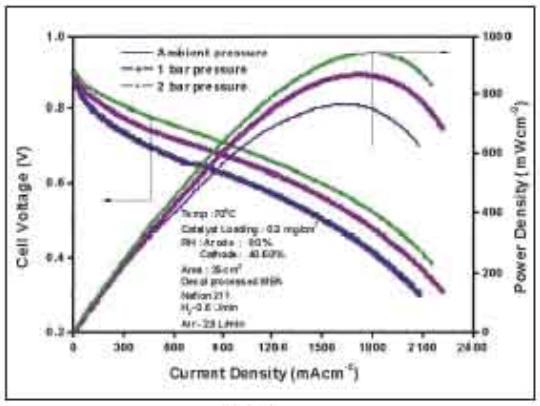


Fig. 7

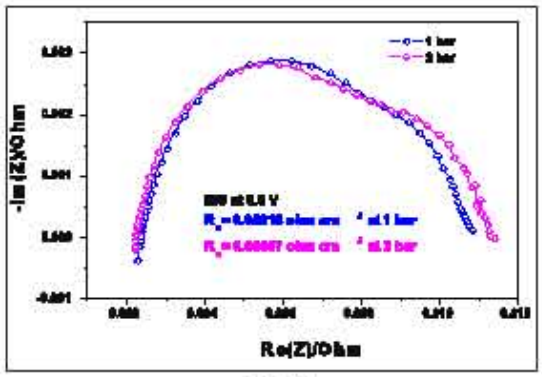


Fig. 8

Test parameters	Current density @ 0.6 V (mA/cm²)			Power density @ 0.6 V (mW/cm²)			Peak power density (mW/cm²)		
	Exp 1	Exp 2	Exp 3	Exp 1	Exp 2	Exp 3	Exp 1	Exp 2	Exp 3
Ambient Pressure	670	896	1066	402	538	641	535	650	765
At 1 Bar	1155	1317	1341	693	793	805	770	865	868
At 2 Bar	1292	1583	1495	775	951	897	813	980	942

Table .1

TAPSUN PROJECTS

NWP-54

Novel approaches to solar energy conversion (TAPSUN–FLEXISOLAR)

Division involved	: Functional Materials; Corrosion and Materials Protection; and Electrodics and Electrocatalysis
Nodal officer	: Dr. Suresh Chand, CSIR-NPL
Members	: Dr. M. Selvaraj, Dr. D. Jeyakumar, Mr. S. Ramu, Dr. S. Palraj, Mr. K. Maruthan, Dr. N. Lakshminarasimhan and Dr. James Joseph
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2011 - March 2017
Budget	: Rs 92.6 lakh

Objectives

- Development of solar paint based on dye-modified nanoporous titanium dioxide polymer hybrids;
- Design and synthesis of new acceptors and polymeric sensitizers; and
- Development of an indigenous method for electron transport layer coating.

Highlights

- DSSC with gel electrolyte was fabricated and tested (efficiency 6.3%). MoS_2/carbon paste counter electrode was fabricated and tested for I^-/I^{3-} redox couple. DSSC was constructed using MoS_2/carbon paste counter electrode with Gel electrolyte and evaluated (efficiency 4.5%). RGO-Ag NW composite material was prepared and coated over glass plate. 20-nm TiO_2 film was coated on ITO electrode and characterized as ETL.
- Reduced graphene oxide: silver nanowire composite was prepared and spin-coated onto glass substrate as substitute for ITO glass. The conductivity of the composite was studied. A gel electrolyte based on polyethylene oxide and polyethylene glycol was prepared and used for the fabrication of DSSC. The performance was evaluated and found to be around 6%. In the development of alternate counter electrode (CE) substituting Pt-coated ITO CE, MoS_2/CB composite was studied in detail for its application in DSSC. It was observed that CE fabricated using 40:60 MoS_2:CB composite surpass the photo-conversion efficiency of DSSC that employed Pt-CE. Poly(2,7-(9-hexyl)carbazole)-alt-(benzthiadiazole) appended with porphyrin was carried out and their spectral characterization was carried out.

A gel electrolyte for DSSC and MoS_2-based counter electrode for DSSC was developed.

NWP-56

Innovative solutions for solar energy storage (TAPSUN)

Division involved : Electrochemical Power Systems
Nodal Officer : Dr. S. Gopukumar
Members : Er. S. Ambalavanan, Dr. M.V. Ananth, Dr. I. Arul Raj, Dr. M. Ganesan, Dr. N. Kalaiselvi, Mr. K. Manimaran, Dr. P. Periasamy, Dr. A.S. Prakash, Dr. P. Ragupathy, Dr. T. Raju, Dr. K. Ramesha, Dr. C. Sivakumar, Dr. A. Sivashanmugam and Dr. R. Thirunakaran
Sponsor : Council of Scientific and Industrial Research
Duration : March 2011 – November 2017
Budget : Rs 71.67 crore

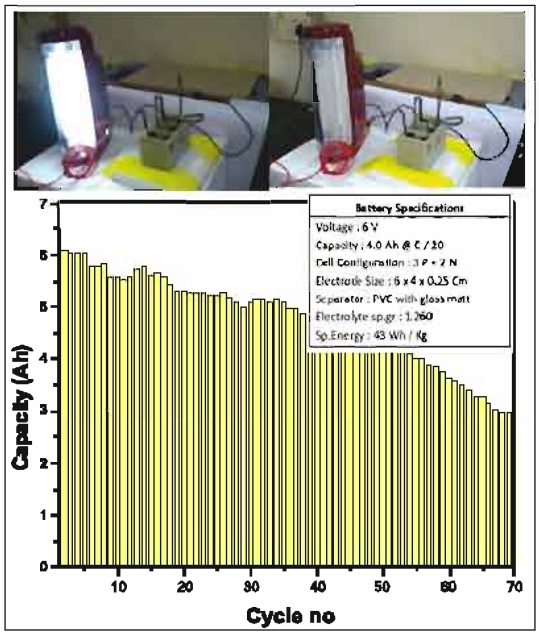
Objectives

- Weight reduction of lead electrodes in lead-acid batteries;
- Direct metallization of lead on plastics using intrinsic conducting polymers;
- Electroplating of lead on carbon fiber sheet and modified C-fiber paper by *in situ* incorporation of copper nanoparticles;
- High-performance anode material with a specific capacity >500 mAh/g;
- High-performance cathode material with a specific capacity >180 mAh/g;
- 3.6V/650 mAh lithium-ion battery for LED lighting applications;
- Novel materials for futuristic energy storage systems like lithium/air, supercapacitor, zinc–bromine and magnesium batteries.

Highlights

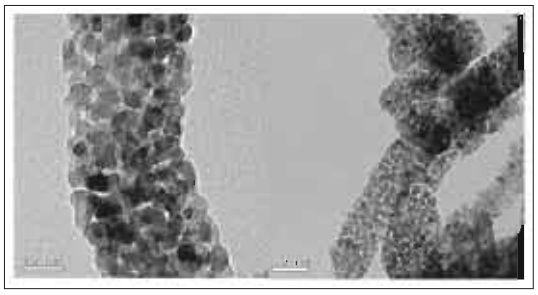
- *Light-weight lead-acid batteries*: 2V / 3.0 Ah cells were fabricated with improved design by using lead-coated plastic grids supplied by NPL.
- Due to reduction in the weight of the negative grid, the specific energy of the cell was improved to 49 Wh/g. Batteries incorporating lead-coated plastic grids were also fabricated. 6V / 4 Ah modules were used for CFL lighting.

Lead alloy grid with punched design (left) and Lead-coated plastic grid with dove tail design (right)



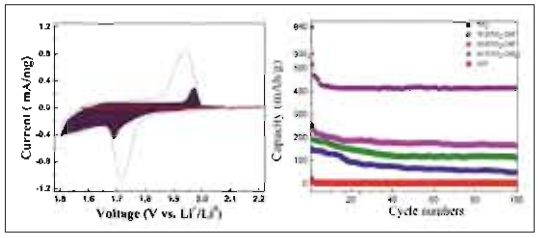
Performance of 6 V / 5 Ah battery with CFL (12 W, 0.7 A).

- *Anode materials*: Among anode materials studied were: TiO_2-coated CNT, modified Si and composites such as Si/C, TiO_2/Si/graphene, r-GO/nano Sn and NMP-exfoliated graphene nanosheet–SnO_2. TEM images revealed spherical TiO_2 particles (5–10 nm) over CNTs, giving and overall diameter of 20–50 nm for the TiO_2-coated CNTs. At C/5 rate, a 25% TiO_2-coated CNT gave 500 mAh/g of which 345 mAh/g corresponds to charge storage due to surface reaction and 155 mAh/g to lithium insertion (0.46 Li / TiO_2). An Si-C composite made by moderate heating gave 3,000, 2200 and 950 mAh/g in the first and 30th and 100th cycles.

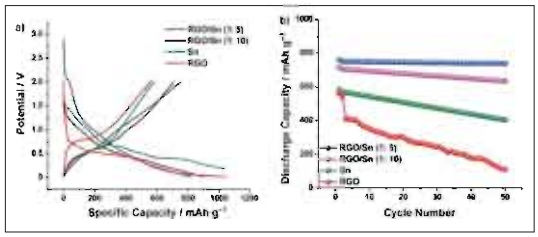


TEM images of TiO_2/CNT composite.

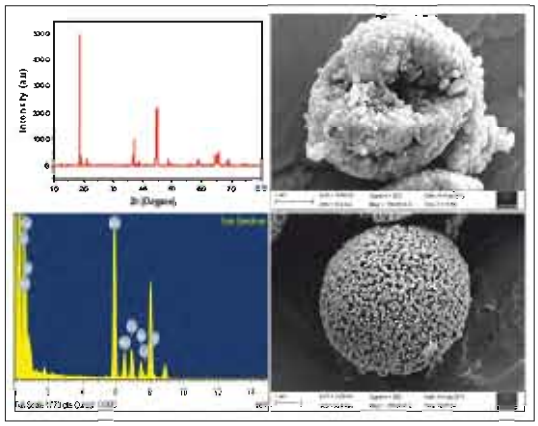
- In another study, graphene was used to decorate a TiO_2–Si nanocomposite. Graphene decoration led to an increase in the capacity from 710 to 765 mAh/g at a current density of 50 mA/g. However, the capacity was stable only up to five cycles.
- In another study, r-GO was anchored to nano Sn particles (5–10 nm, synthesized by reduction of $SnCl_2$ by $NaBH_4$). The high capacity (885 mAh/g) and capacity retention (97%) observed with this material is ascribed to the flexible r-GO matrix and uniform distribution of Sn particles.
- Graphene nanosheets (GNS) were grinding and sonication graphite in NMP and used for the preparation of GN5-SnO_2 composite (19.5% graphene). At a current density of 300 mA/g, the capacity retention of the cell after 42 cycles was almost 100%.



Cyclic voltammogram of TiO_2/CNT(25%-75%) (left) ond Copocity retention plot of TiO_2/CNTs ond F-CNT (right)

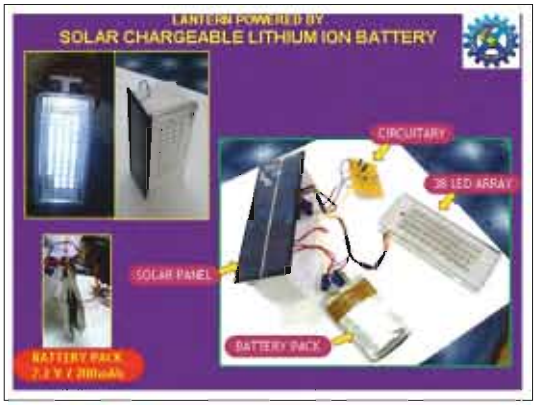


- *Cathode materials*: $LiCo_{1-X-Y}Mg_xCu_yO_2$ cathode material was synthesized by microwave method using nitrate precursors and ball-milled. The material had a surface area of 28 m^2/g and delivered ~175 mAh/g at 0.2 C rate. Cathode-active materials such as hollow microspheres of $Li_{1+x}Mn_{0.6}Ni_{0.1}Co_{0.1}O_{2\pm\delta}$, Li_2MnO_3-stabilized layered oxides and $Li_{2+y}Co_xMn_{3-x}O_8$ were synthesized by different approaches: surfactant-assisted sol-gel, carbonate precipitation and polymer template-assisted co-precipitation. The hollow microsphere layered oxides exhibited a capacity of >190 mAh/g.

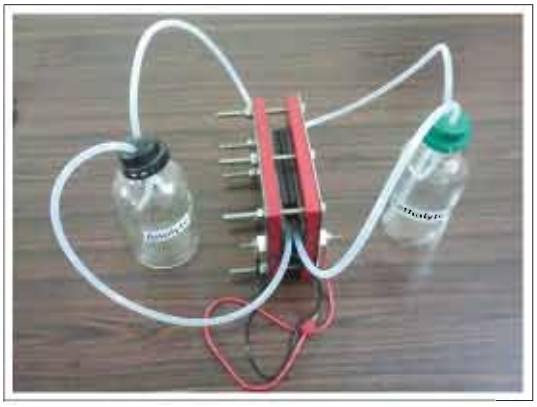


Hollow microspheres of $Li_{1+x}Mn_{0.6}Ni_{0.1}Co_{0.1}O_{2\pm\delta}$ prepared by carbonate precipitation method.

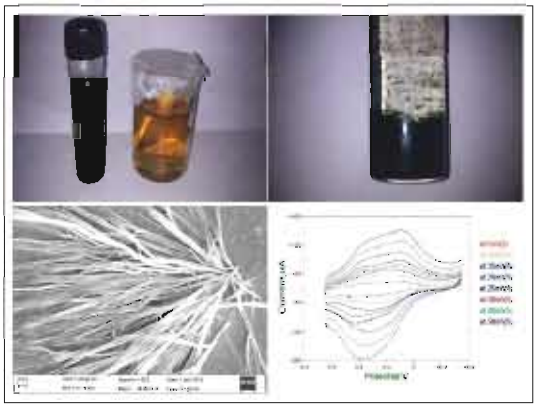
- *Integration*: Based on the experience gained from break-open analysis, electrode parameters and assembling patterns of pouch cells were designed. Electrodes for stack (14 electrodes, 50 mm x 35 mm) and wound (1 electrode, 490 mm x 35 mm) configurations were designed. Moreover, optimization of unit operations for the fabrication of 3.6V / 650 mAh lithium-ion pouch cell was undertaken with commercially available anode and cathode materials. Specifically, the following operations were optimized for electrode preparation: ratio of anode-to-cathode material mass; amounts of carbon black, PVDF and solvent for obtaining uniform and defect-free coating; slurry mixing for coating prepared by mechanical stirring by monitoring the viscosity of the slurry; coating trials both manually and with film coating machine; speed of coating speed; control over coating thickness; coating area. Expertise in preparing ribbon electrodes of 490 mm breadth was gained.
- *Solar lantern*: Proof of concept of powering an LED solar lantern with the assembled 3.6V / 400 mAh pouch cell was established. The lamp with 40 LEDs lasted 5–6 hours per solar charge. The cell pack was tested for more than 100 cycles under standard solar conditions.



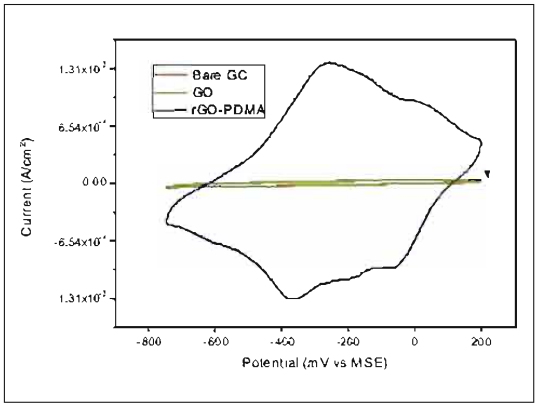
- Zinc–bromine battery. Adsorption and evolution of bromine from electrolytes of different compositions were studied. A single-phase aqueous electrolyte with nitrile-containing organic electrolyte was developed, tested and patented. Additionally, a 30%-fold increase in the mass-controlled region was observed with a grooved bromine electrode. A ten-cell stack delivering 10 W was demonstrated at IIT Madras.



- *Supercapacitors*: Nano-fibres of PANI and PDMA were inserted into r-GO coated cotton cloth (10 μm thick) and ACF by modified chemical and electrochemical routes and examined for its suitability for supercapacitor application. The maximum weight of r-GO on the fabric was 500 μg /cm^2. SS and Ni were used as current collectors for the fabrication of symmetrical capacitor (1 cm x 1 cm and 2 cm x 2 cm). The flexible device was tested with 0.5 M H_2SO_4 and 0.5 Na_2SO_4 as electrolytes. A green route was evolved for the reduction and surface functionalization of graphene by *in situ* polymerization of 2,5-dimethoxyaniline



In-situ formation of PDMA/graphene.



CV of GC, GO and r-GO–PDMA in 0.5 M H_2SO_4 at 50 mV/s.

Flexible graphene-PDMA film on membrane filter PTFE.

(DMA) and GO. DMA reduces the epoxy functionalities of GO, resulting in large surface area, functionalized graphene films, 3D nanoribbon/nanofiber morphologies and flexible electrode materials.

NWP-56

Solar to chemical conversion systems and devices

Division involved	: Electro-Inorganic Chemicals; and Electro-Pyrometallurgy
Nodal Officer	: Dr. S. Ravichandran
Members	: Dr. G. Sozhan, Dr. S. Vasudevan, Dr. D. Jonas Davidson and Dr. John Berchmans
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2011 - March 2017
Budget	: Rs 71.67 crore

Objectives

- To develop a photoelectrochemical device with a hydrogen evolution rate of 250 ml/h.

Highlights

- TiO_2 nanotubes as photoanode and ferrites as photocathode for improved photoconversion efficiency with 0.8 V (OCV) and 0.4 mA/cm_2. Parallel stacking of two photoanodes (α-Fe_2O_3 /TiO_2) with improved PEC activity was developed. Carrier density of $0.6x10^{20}/cm^3$ for bare TiO_2 photoanodes increased to $0.3x10^{21}/cm^3$ for stacked photoanodes (α-Fe_2O_3/TiO_2). CdS-sensitized surface-modified titania nanotube photoanode showed improved photocurrent density of 2.2 mA/cm^2 than the bare titania nanotubes photoelectrode (0.14 mA/cm^2)


CSIR
12TH FYP PROJECTS
CECRI

XPS Multilab 2000 (Thermo Scientific)

CSC-0101

Multifunctional electrodes and electrolytes for future technologies (MULTIFUN)

Division involved	: Electrochemical Power Systems, Electrodics and Electrocatalysis, Chlor-Alkali, Electrochemical Materials Science, Functional Materials
Nodal Officer	: Dr. N. Kalaiselvi
Members	: Dr. K.L.N. Phani, Dr. S. SenthilKumar, Dr. S.M. SenthilKumar, Dr. Thangamuthu, Dr. G.N.K. Ramesh bapu, Dr. M. Eashwar, Dr. G. Sreedhar, Dr. Deepak Kumar Pattanayak, Dr. K. Subramaniam, Dr. S. Rajagopal, Dr. V. Saraswathy, Dr. S. Muralidharan, Dr. R. Vedhalakshmi, Dr. S. Muralidharan, Dr. S.P. Manoharan, Dr. Sekhar, Dr. Palani Natarajan, Dr. N. Lakshminarasimhan, Dr. D. Jeyakumar, Dr. P. Murugan, Dr. M. Sathish and Dr. Sailaja Krishnamoorthy
Sponsor	: Council of Scientific and Industrial Research
Duration	: 2012–2017
Budget	: Rs 68.54 crore

Objectives

- Basic studies of functionalized interfaces for better understanding of electrochemical phenomena at the interface and application of knowledge thus generated for development of photo-functional materials, electro-chemiluminescence-based biosensors, sensors for the detection of phenolic contaminants, detection of toxic metal ions and biomarkers, a rapid-cum-multiplexed sensing of food-borne pathogens and for engineering electrocatalytic interfaces for green chemistry;
- Development of novel inhibitors for materials protection; triboluminescent materials for detection and healing of cracks and to develop integrated smart sensors for high rise structures; and
- Development of energy-efficient electrodes for detection and enhanced recovery of metals from ores; energy-efficient oxygen depolarised gas diffusion-cathode incorporated chlor-alkali cell assembly; decorated carbonaceous materials for OER/ ORR applications and modified polyanionic hosts as multifunctional electrodes and electrolytes.

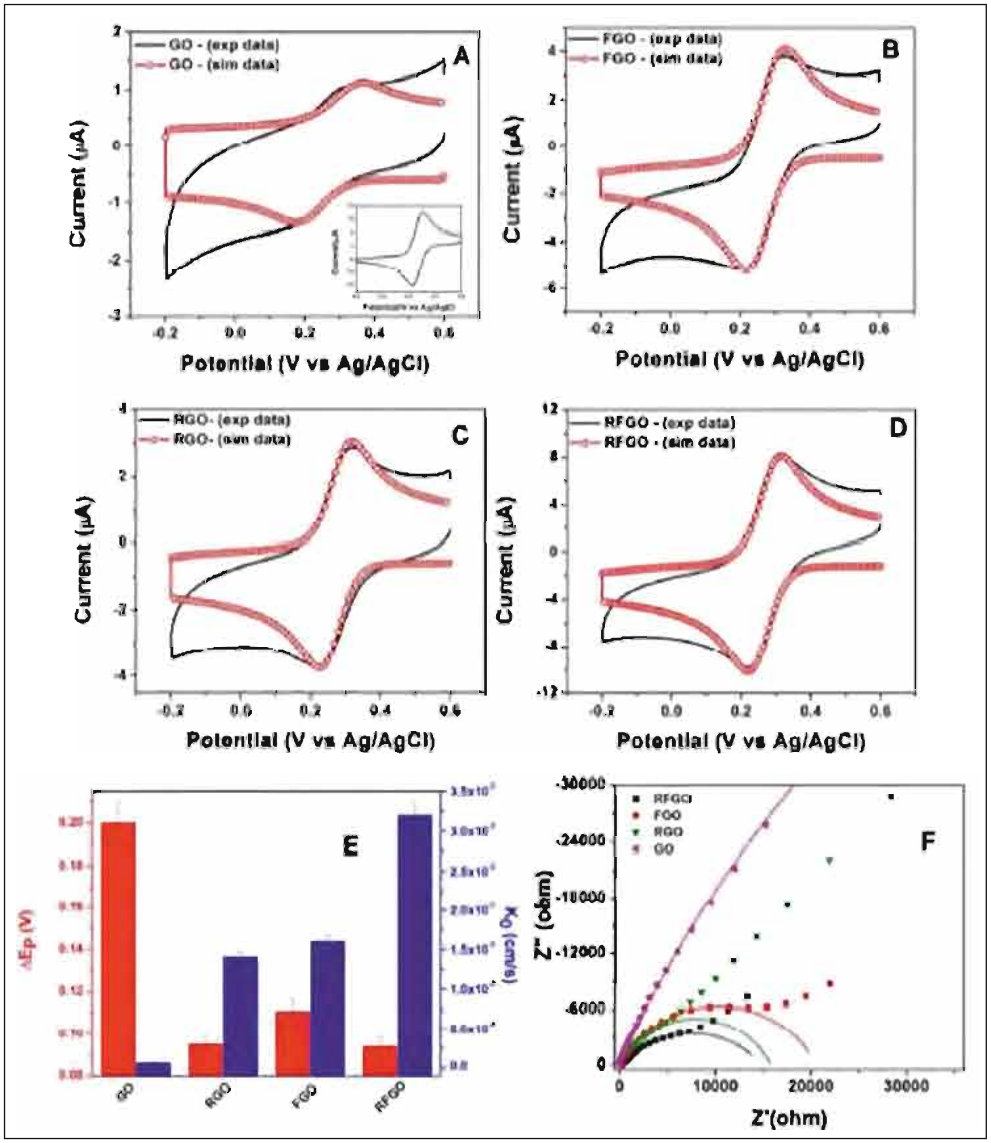
Highlights

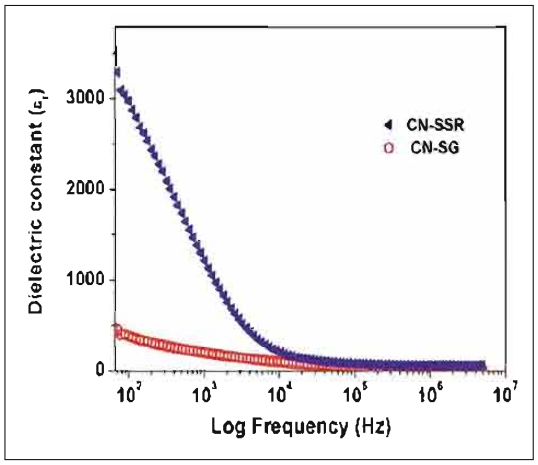
- Indigenous multi-sensor (embeddable type) gadget for simultaneous measurement of potential, corrosion rate and resistivity for use in thermal power stations, nuclear reactors, ports and bridges (near completion). Chlor-alkali cell with oxygen depolarized gas diffusion cathode that leads to a reduction in cell voltage of 1.23 V and an energy savings of 824 kWh/t NaOH. Light-weight lead, nickel and copper foams prepared by an indigenous electrochemical method for use in

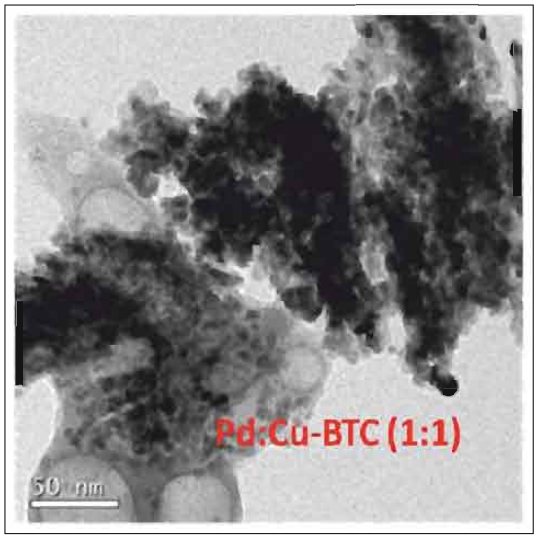
electrochemical energy storage assemblies. Embeddable MnO_2 sensor for underground corrosion monitoring applications. Development of a novel, simple, rapid and green (chemical-free) method for SEM documentation of marine fouling diatoms (will be patented shortly).

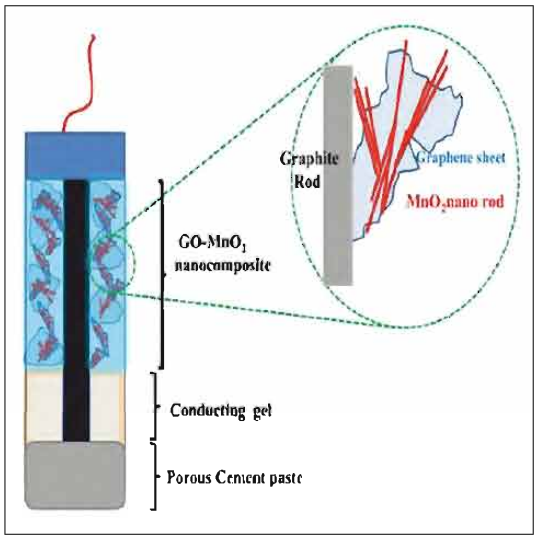
Following are the glimpses of interesting results obtained under various work packages:

- *Functionalized interfaces*: Facile electrochemical synthesis of Au–NiO core-shell type bi-functional electrodes with high electrocatalytic activity for OER and ORR. Improved heterogeneous electron transfer kinetics of fluorinated graphene oxide derivatives. Application of palladium nanopartilces filled into the pores of Cu-BTC (MOF) for enhanced SERS signals. Surface-modified phosphors for white emission. Tunable dielectric properties of $CrNbO_4$ (CN-SSR and CN-SG) by micro-structural control.

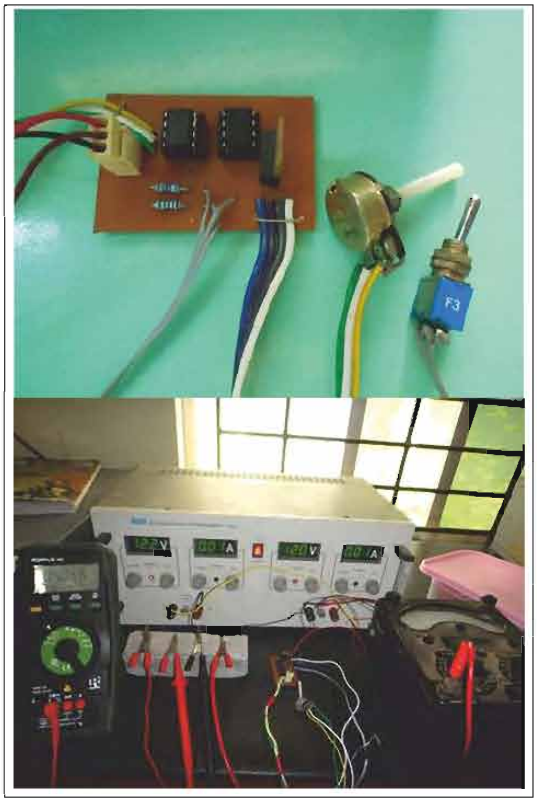


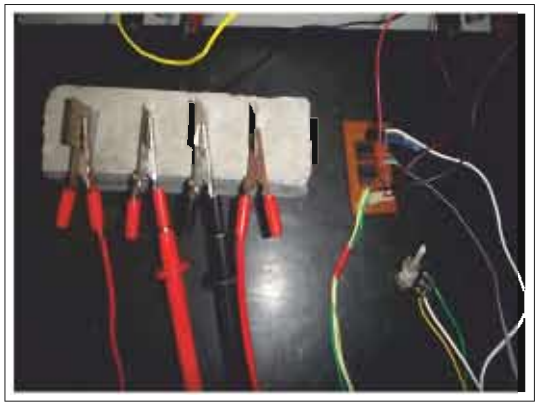






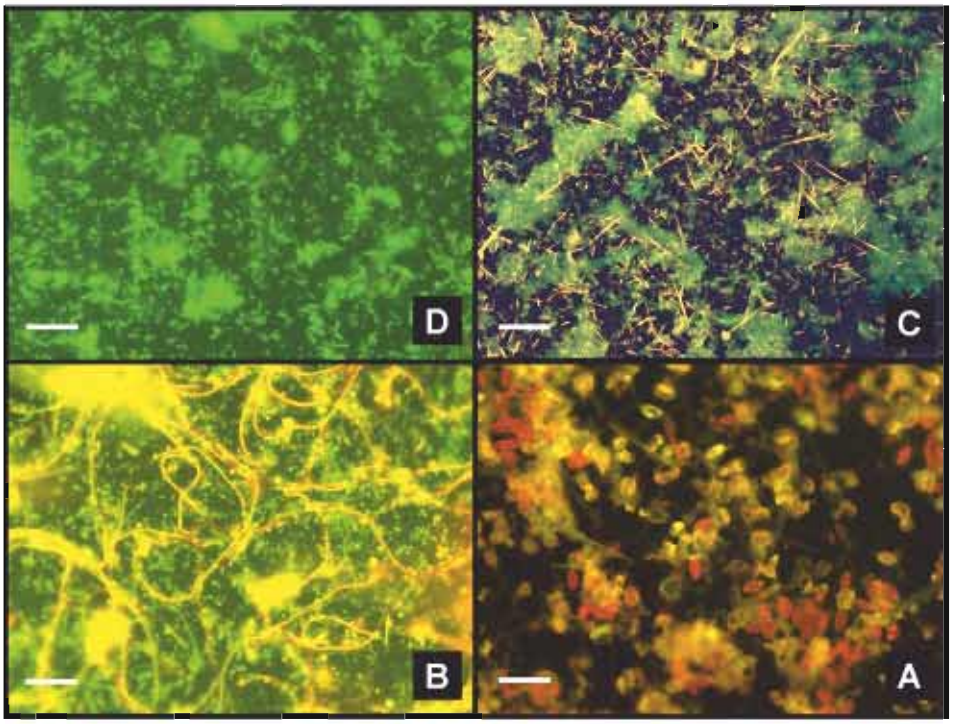
- *Materials protection*: An attempt was made to use graphene-functionalized MnO_2 nanorod as an electrochemical sensor for corrosion monitoring application in reinforced concrete structures. The electrochemical sensor was assembled using GO-MnO_2 nanorod as an embeddable type suitable for concrete structures. The stability of embeddable sensor in synthetic concrete pore solution was found to be constant throughout the exposure period of 90 days, which projects it as a promising candidate as an embeddable potential sensor for concrete structures for corrosion monitoring applications. Novel triboluminescence active tetrahedrally coordinated manganese(II) complexes such as bis(methyltriphenylphosphonium) tetrabromomanganate and bis(methyltriphenylphosphonium) dibromodichloromanganate were synthesized using aprotic and protic solvents. Durability was increased from 1 day to 80 days.



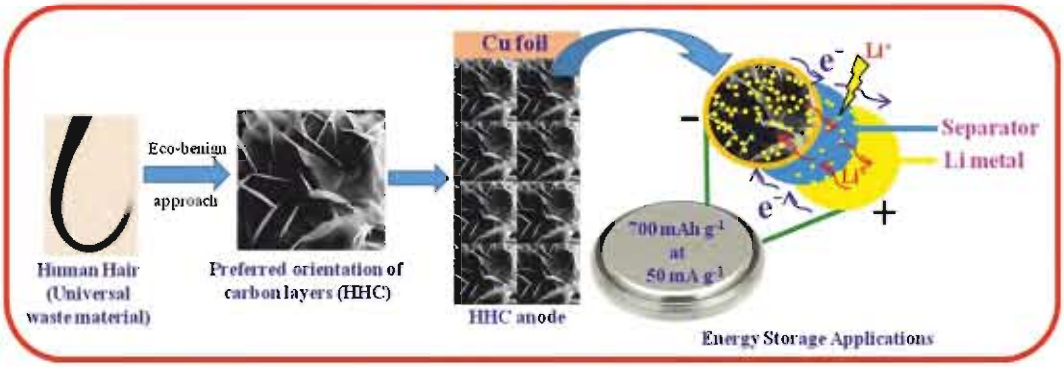


Tantalum resistivity sensar embedded in concrete.

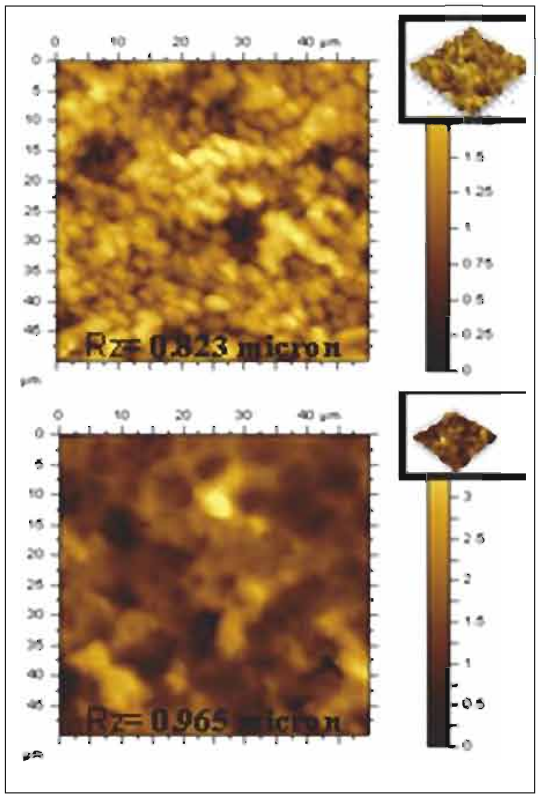
- *Energy efficient electrodes:* N-doped graphene was prepared using N-containing organic compounds (urea, dimethylglyoxime and glycine) and GO as precursors in supercritical water-assisted synthesis. Nitric acid-assisted supercritical synthesis of N-doped graphene using GO and urea showed a high specific capacitance of 271 F/g. Human hair-derived carbon was developed for energy storage and ORR/OER applications. Light-weight lead, copper and nickel foams were prepared using an electrochemical approach.



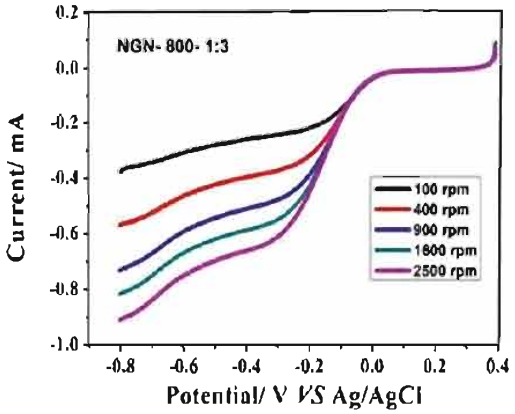
Fluorescence image of biofilms obtoined under different conditions of exposure to sunlight.



Indigenously prepared copper foam.



Topography controlled TI anode surface and N-doped graphene for ODGDC cells.



Topography controlled Ti anode surface and N-doped graphene for ODGDC cells.

CSC-0103

Electro bio-cell for remediation and energy from sludge (ZERIS): Zero emission research initiative for solid waste

Division involved	: Corrosion and Material Protection
Nodal Officer	: Dr. S. Maruthamuthu
Members	: Dr. K. Subramanian and Dr. G. Rajagopal
Sponsor	: Council of Scientific and Industrial Research
Duration	: June 2013 – May 2018
Budget	: Rs 30 lakh

Objectives

- Removal of chromium from leather effluent using electrochemical technique;
- Electro-oxidation and biodegradation of organic leather waste; and
- Development of microbial fuel cell using organic leather waste.

Highlights

- Removal of chromium from tannery effluent using electrochemical technology. Isolation and identification of bacteria from organic leather waste. Electro-biodegradation of organic leather waste. Feasibility study on microbial fuel cell was initiated using organic leather waste.
- Tannery industrial's sludge and waste waters carrying chromium is of particular environmental concern due to its toxicity and it is very challenging to remove from tannery wastewater. It quickly diffuses through soil and aquatic environment and creates hazardous effects on living things. Many methods are available to remove chromium pollutants such as adsorption, membrane filtration, and bio-accumulation. Currently calcium and magnesium are added in chromium removal process. These methods are time-consuming and are not feasible when compared to electrochemical methods which can be applied to remove chromium from tannery effluent effectively. In the present study, the effluent was electrolyzed in two different types of electrochemical reactors, namely, undivided cell and divided membrane cell. The effluent in the cathode compartment in both the cells IrO_2-TiO_2 based TSIA (titanium substrate insoluble anode) or platinized titanium anode, titanium mesh cathode and per fluorocarbon based sulphonic acid cation exchange membrane were used in the study. The parameters such as chromium ion concentration, COD removal and TOC were evaluated before and after the electrolysis. Based on the results, a feasible approach for removal of chromium (>90%) from leather effluents has been suggested.

CSC-0105

Potassic fertilizer technology to empower the nation (K-TEN)

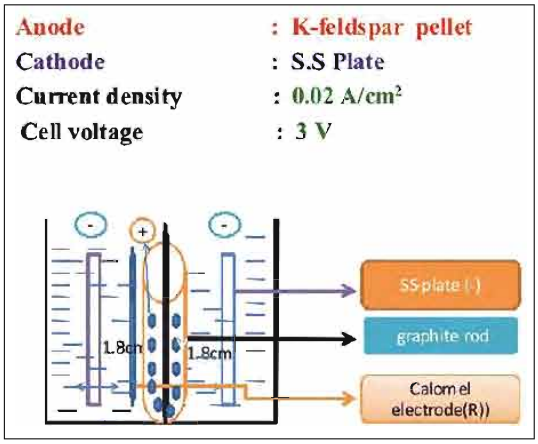
Division involved	: Electro-pyrometallurgy
Nodal Officer	: Dr. L. John Berchmans
Members	: Mr. V. Nandakumar, Dr. S. Angappan, Mr. N. Sathaiyan and Dr. G. Sreedhar
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2012 – March 2017
Budget	: Rs 2.45 crore

Objectives

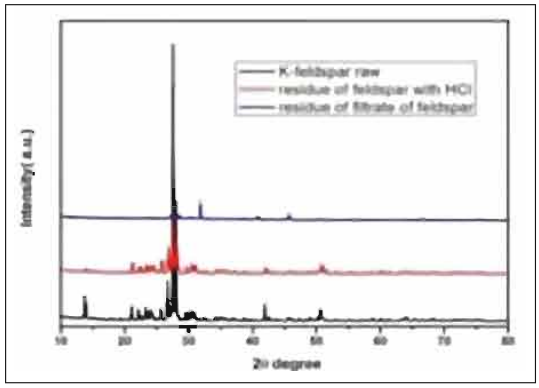
- Extraction of potash from Indian mineral resources such as feldspar and glauconite by metallurgical processes;
- Application of hydrometallurgical and electrometallurgical processes for the trapping of K from its minerals; and
- Identification of suitable processes and the development of a laboratory-scale technology for effective separation of potash from Indian minerals.

Highlights

- Potash fertilizer has played an important role in Indian agriculture industry in attaining self-sufficiency in food grains production. The total resource of potash in the order of 20,398 million tons from various sources such as evaporate deposit, sea bitterns, glauconite, etc. have been identified in our country. But, there is practically no viable technology for the production of potash in our country.
- The raw material K-feldspar was received from CSIR-CSMCRI Bhavnagar, to explore the possibility of separating potash from the mineral. The mineral was analyzed for its elemental composition by XRD and AAS. The concentrations of K, Na, Ca, Al and Si and their respective oxides were assessed using various analytical methods. Leaching was carried out in different acid media such as HCl, HNO_3, H_2SO_4 and H_3PO_4. Electroleaching was used as a novel technique for easy dissolution of potassium. The leached and concentrated solutions were further evaporated to obtain potassium oxide, which will be used as a fertilizer. The concentrations of individual elements like K, Na, Ca, Al and Si were assessed using AAS.



Schematic diagram for electro leaching of K-Feldspar mineral.



XRD spectra of raw and leached mineral.

- It was observed that all the four acids dissolved potassium along with other elements like Na, Ca and Al. Si could not be easily leached out of K-feldspar because of its stability in acid media. Heating was found to promote the dissolution of potassium from K-feldspar mineral. K-feldspar is a very complex oxide and poor in electrical conductivity and, hence, anodic dissolution of K is complex. Further studies are in progress on the leachability kinetics in different media of K-feldspar mineral.

CSC-0113

Bio-electrokinetics and electro-oxidation processes for degradation of textile industrial effluent (SETCA)

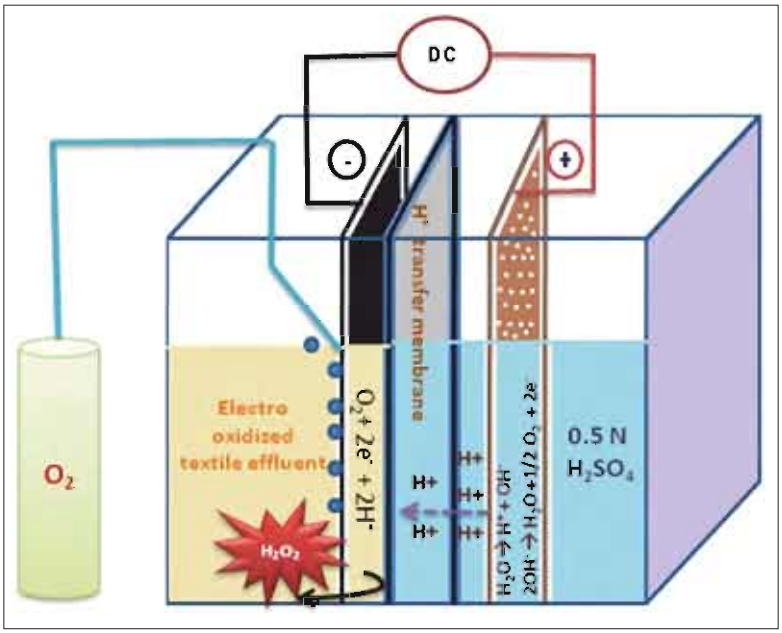
Division involved	: Corrosion and Material Protection; and Chlor-Alkali
Nodal Officer	: Dr. S. Maruthamuthu
Members	: Dr. K. Subramanian, Dr. G. Rajagopal and Dr. B. Ramesh Babu
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2012 – March 2017
Budget	: Rs 40.83 lakh

Objectives

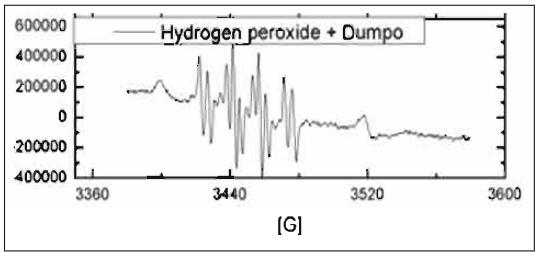
- Design of an electrokinetic cell for removal of pollutants, namely, contaminated dyes and trace metals in the soil in textile industry;
- Degradation of dyes in soil and effluent collected from textile industry; and
- Modeling and gadget development.

Highlights

- *Removal of dye components and improvement in fertility of the agricultural soil by bio electrokinetics*: This study relates to the development of a bio-electrokinetic process for the removal of pollutants from the soil. Starch with aromatic degrading bacteria such as *Pseudomonas sp* and cellulose degrading bacteria were used as anolyte, which moves towards cathode, via electroosmosis process in electrokinetic technique. The reduction of COD was in the range of 70–75%. The inorganic impurities of chloride, sulfate and trace metal ions were removed by electromigration process. Significant reduction of conductivity and TDS can be achieved by bio-electrokinetic process. The injection of starch with bacteria and removal



Electrochemical cell setup for H_2O_2

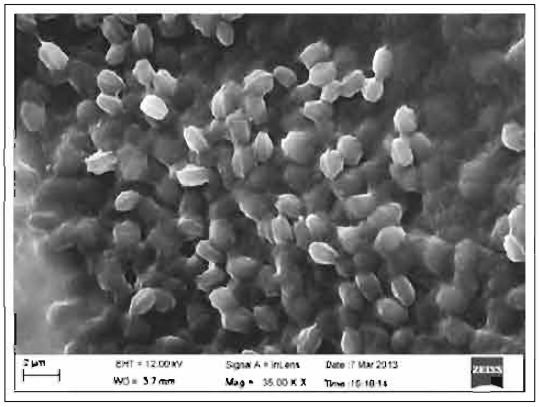


EPR spectra for oxygen radical along with the spin trap.

of pollutants improve the fertility of the agricultural soil.

- *In situ electrogeneration of hydrogen peroxide for advanced oxidation of recalcitrant organic compounds present in textile effluent*: In this study, H_2O_2) was generated electrochemically in situ using textile effluent. Prior to H_2O_2 generation, the effulent was decolourized by hypochlorite generated electrochemically at anode (TSIA) using Ti as cathode at 20 mA/cm^2 for 30 min. No salts were added in the effluent as native conductivity (12.5 ms/cm) and NaCl concentration (2.2 g/l) were sufficient to act as electrolyte as well as a source for generation of hypochlorite. The H_2O_2-generated effluent was then exposed to UV light of 254 nm for 30 min. for generation of OH and superoxide radicals. OH radicals have a higher oxidizing potential and are able to oxidize the recalcitrant heteroatom-containing organic compounds. There was 59.5% decrease in COD by combined electro oxidation of textile effluent via HOCl and H_2O_2 . The formation of oxygen radicals (both OH and superoxide) was confirmed by EPR spectroscopy.

- *Biogenic ammonia for CO_2 capturing and electrochemical conversion of carbon dioxide to bicarbonate and formate*: Capturing and conversion of CO_2 into useful chemicals will render greater impact in reducing the conversion of CO_2 in the atmosphere. In this study, a novel 'bio-assisted electrochemical system' was employed for carbon dioxide conversion. Biogenic ammonia was used as a biocatalyst produced from synthetic urine by ureolytic bacteria for CO_2 conversion. The biocatalysts, *Serratia ureilytica* and *Serratia marcescens*, were isolated from railway track fecal contaminant. A TSIA electrode was used as anode and a lead-coated SS316 wire mesh was used as cathode in electrochemical system. Nafion 961 membrane was used for the transport of cations (Nh_4^+, H^+) from anode to cathode chamber. The experimental parameters were optimized at a current density of 100 mA/cm^2. The final products of ammonium bicarbonate and formate were collected from the cathode chamber



An FE-SEM view of ureolytic bacteria for CO_2 conversion.

CSC-0114

Intelligent coatings (Intel-COAT)

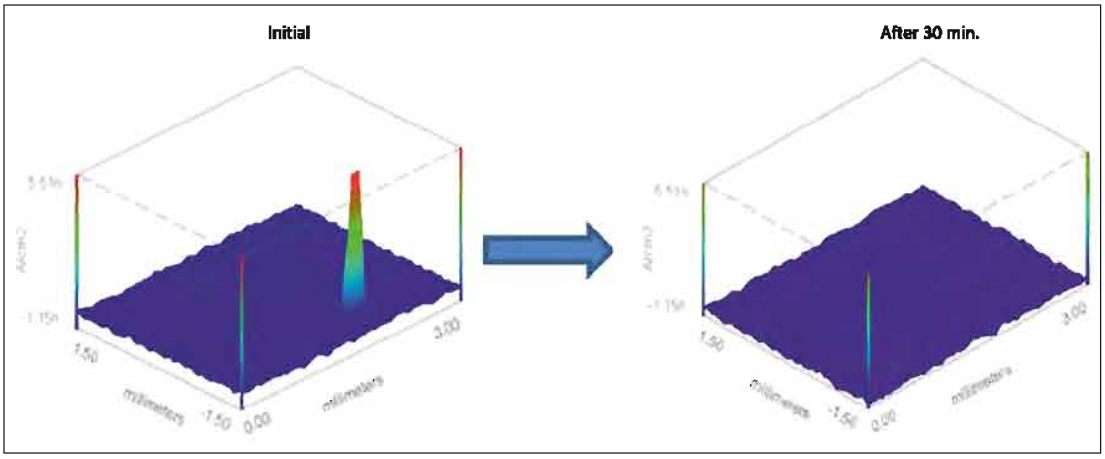
Division involved	: Corrosion and Material Protection and Industrial Metal Finishing Technology
Nodal Officer	: Dr. S. Sathiyanarayanan
Members	: Dr. S. Syed Azim, Dr. S. Muthukrishnan, Dr. M. Selvaraj, Dr. S. Mohan, Dr. P. Veeramani, Dr. S. Muralidharan, Er. K. Saravanan, Dr. S.S. Sreejakumari, Dr. S. Palanichamy, Dr. S. Panda, Dr. C. Naveen Kumar, Dr. Nathira Begaum, Dr. Silaimani, Dr. S. Palraj, Dr. S. Jha, Dr. M. Eashwar, Dr. G. Subramanian, Mr. S. Ramu, Dr. M. Sundar and Dr. T.N. Narayanan
Sponsor	: Council of Scientific and Industrial Research
Duration	: August 2013 – July 2018
Budget	: Rs 1.91 crore

Objectives

- Development of Intelligent coatings having nano/submicron reservoirs with controlled release of corrosion inhibitors;
- Development of multi-functional super-hydrophobic coatings;
- Development of high-performance coating system for steel surface;
- Development of anti-fouling coatings using microencapsulated biocide and marine natural products;
- Development of intelligent corrosion sensing and eco-friendly pre-paint coatings;
- Development of industrially applicable corrosion resistant organic and inorganic hybrid coatings on light alloys and composite structures and engineering components;
- Development of high-performance bi-polar coatings containing electroactive polymers;
- Development of economical and efficient corrosion resistant coatings systems for rebars embedded in concrete structures; and
- Development of thermal barrier coatings for high temperature applications.

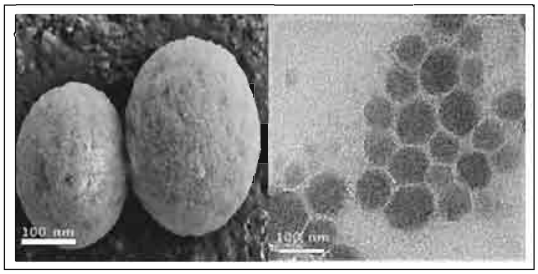
Highlights

- Intelligent coating based on sol-gel containing nano-reservoir. Silver-decorated fluorinated graphene oxide based-super-hydrophobic antimicrobial coating. Super-hydrophobic and oleophobic layered fluorinated graphene oxide-polymeric composite films. Super-hydrophobicity on metal surfaces by chemical grafting. Zinc-rich primer on steel substrate using an inhibitor-impregnated mesoporous titania. Development of anti-fouling coatings based on ablative polymers with biocides. Mangrove plant, macroalgae and bacteria have been found to possess anti-fouling properties. Surface modification of silica nanoparticles with imines. Metal-doped nano TiO_2 rods were synthesized and primer coat containing these rods were evaluated. Fly ash was chemically and mechanical treated and acrylic paint formulation made with the treated fly ash. Optimization of nickel coating and corrosion performance evaluation of the same in the laboratory. Sol-gel synthesis and characterization of yittria and zirconia nanoparticles. Development of nickel-tungsten coatings on steel panel.



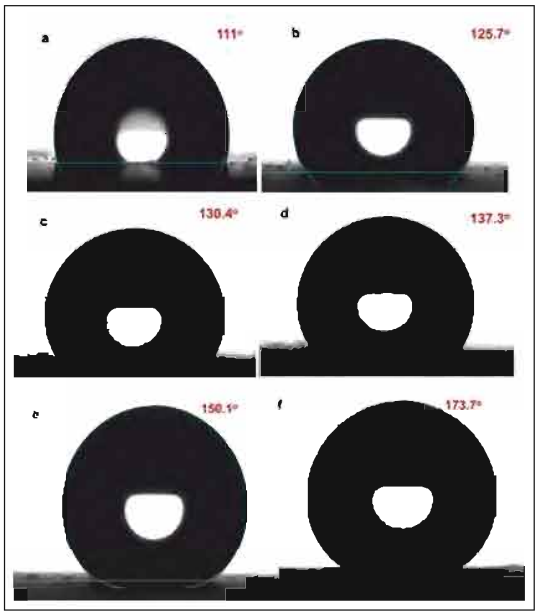
SVET analysis.

- ***Nano-reservoir based intelligent coatings:*** Mesoporous SiO_2 was synthesized by a modified Stober process and loaded with poly aspartic acid. The reservoirs were given multilayers of polyelectrolytes by LBL method. Smart reservoir-incorporated sol-gel coatings were applied over steel and evaluated by EIS and smartness of the coating by SVET analysis.

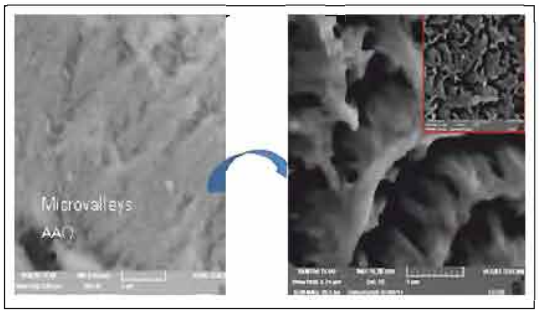


SEM & TEM images of mesoporous SiO_2

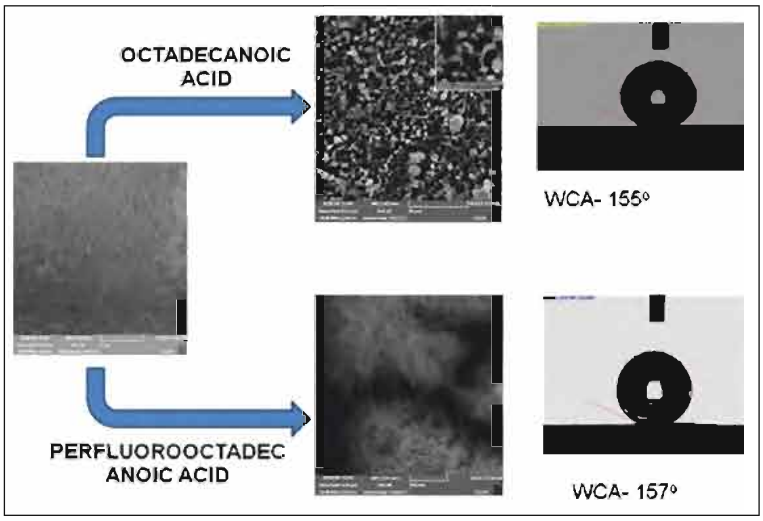
- ***Super-hydrophobic coatings:*** Fluorinated GO (optimum content)-PDMS composite film shows super-hydrophobicity and oleophobicity over the surface with contact angles of 173.7°, 136.2°, 94.9° for water, ethylene glycol and coconut oil, respectively.



Grafting of perflurodecyltriethoxysilane onto as-formed microvalleys.



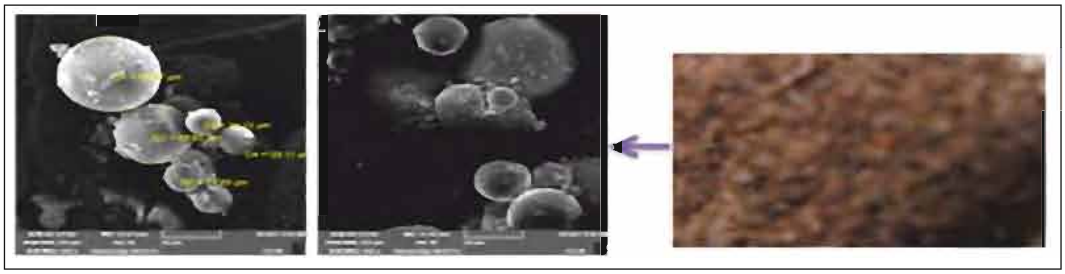
Surface modification of nanoporous AAO using octadecanoic acid and perfluorooctadecanoic acid.



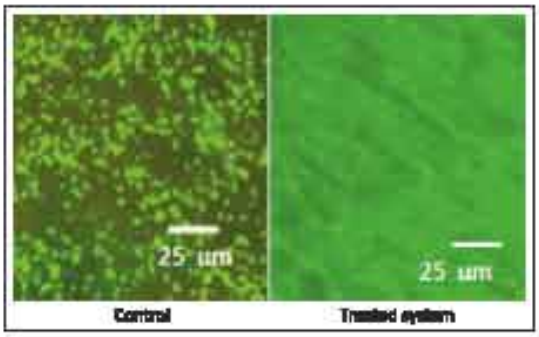
- ***High-performance coatings for steel surface:*** Propargyl alcohol-impregnated mesoporous titanium dioxide (m-TiO_2) in epoxy ZRP composition was formulated and its adhesion was improved by suitable promoters.

Propargyl alcohol-impregnated mesoporous TiO_2

- ***Antifouling coatings containing microcapsules:*** PVA shells micro-encapsulated with Cu_2O, an organometallic compound and an ionic liquid were synthesized, characterized and incorporated into polyurethane, paint which was coated on MS panels. Evaluation of corrosion protective and anti-fouling performance is in progress.
- ***Anti-fouling coatings based on natural products:*** Six marine natural products screened and among them mangrove plant, *Avicennia marina* exhibited broad spectrum of antibacterial activity with a maximum inhibition zone of 17 mm against Micrococcus. Nearly 93% of corrosion inhibition at the concentration of 260 ppm of extract for 5 day exposure to natural sea water and long term exposure for 18 days showed no visual signs of corrosion. The extract also exhibited 99% corrosion inhibition of mild steel in conc. HCl at a concentration of 18,000 ppm.

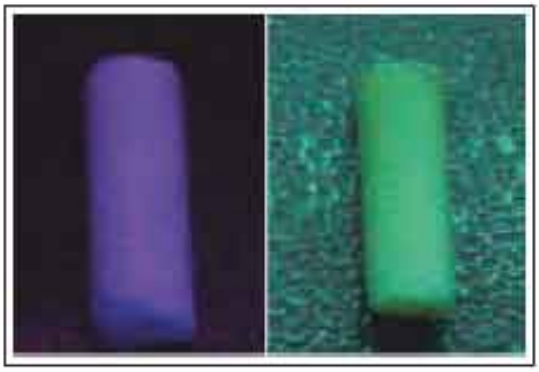


Organometallic compound-incorporated micro-encapsules.



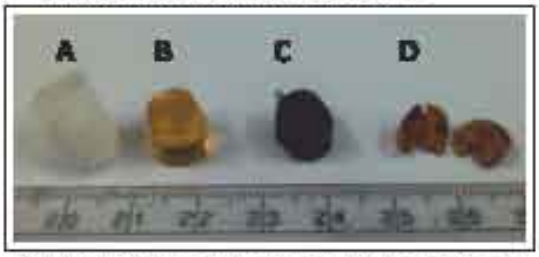
Anti-micro-fouling effect of Avicennia marina extract.

Images of MS coupons in natural seawater (left) without and (right) with inhibitor (250 ppm) after 18 days exposure.

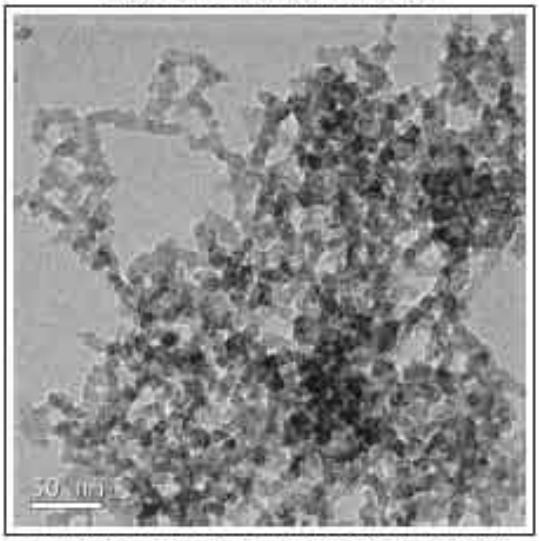


Amine- (left) and imine- (right) modified silica aerogels upon long UV (365 nm) excitation.

- *Intelligent corrosion sensing coatings*: Imine-modified nano SiO_2 was synthesized and characterized. Metal co-ordination was stabler in imine-modified particles than in amine-modified SiO_2. Co-ordination of imine-modified silica with Fe^{3+}, Co^{2+}, Ni^{2+} and Cu^{2+} was studied and was found to be >5 min.

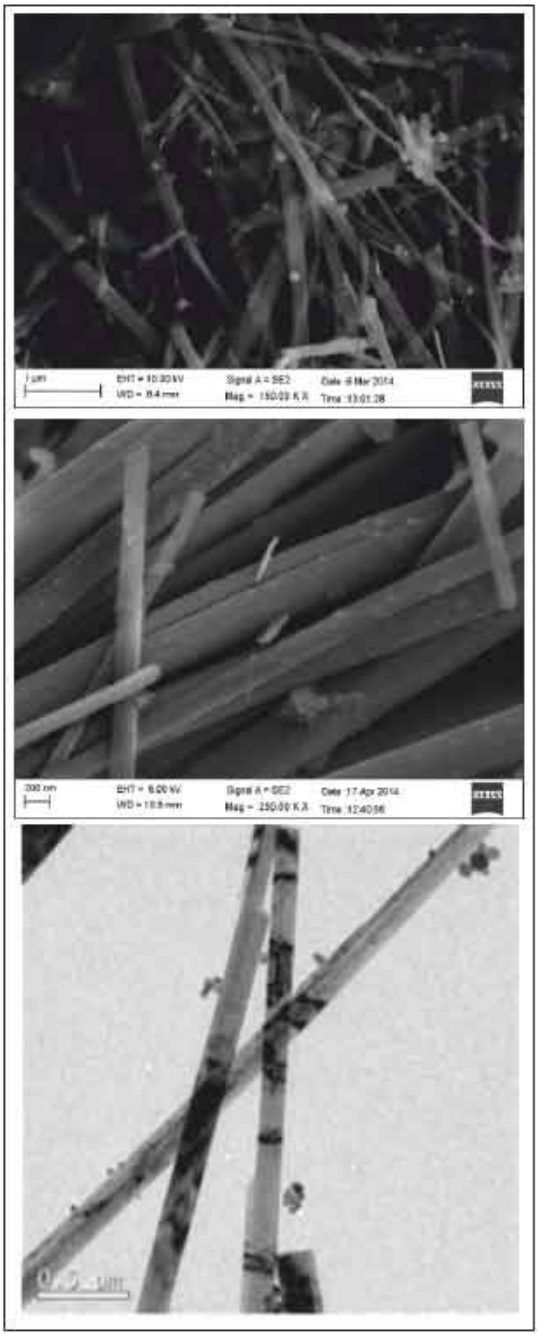


Macroscopic view of metal ion-coordinated silica gel.
A-Amine-terminated silica gel;
B-Imine-terminated silica gel;
C-Cobalt ion-coordinated imine silica;
D-Iron ion-coordinated imine silica.



TEM images of amine- and imine-modified silica.

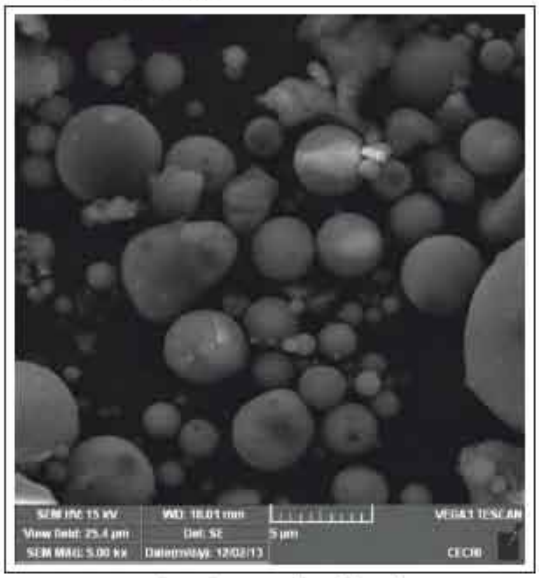
- Hybrid coatings on light alloys composite structures and engineering components. TiO_2 nanorods were synthesized by hydrothermal method and doped with Ca, Ni, Cr and Zn in different weight ratios. Doped TiO_2 nanorods incorporated in acrylic resin was coated on MS substrate and evaluated by electrochemical methods. Photo-corrosion studies with the coated materials were carried out with UV light on/off mechanism.



SEM and TEM images of doped TiO_2 nanorods.

- ***Bipolar coatings***: Poly (aniline-co-p-nitro aniline) was prepared by chemical oxidative method and characterized. Coatings containing HCl-doped co-polymer was found to offer good corrosion protection.

- ***Corrosion-resistant coating system for rebars using industrial waste products***: Surface functionalization using vinyl trimethoxysilane of chemically treated fly ash was carried out in order to improve its adhesion properties. Eight different paint formulations were made with acrylic resin and evaluated by salt spray as per ASTM B117 and potential–time measurements.



Surface functionalized fly ash.

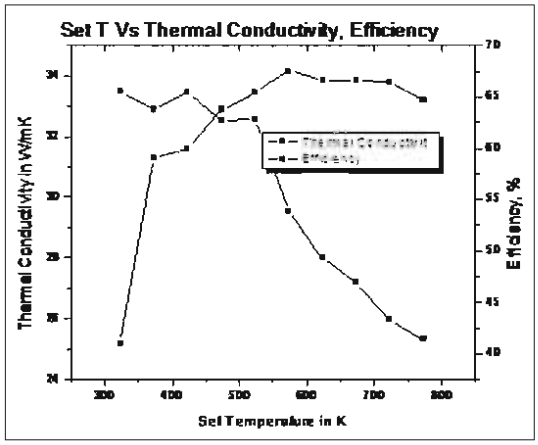
- ***Cost-effective coating system for rebars***: A bath for electrodeposition of nickel on MS was

Nickel-coated rebars for electrochemical studies.

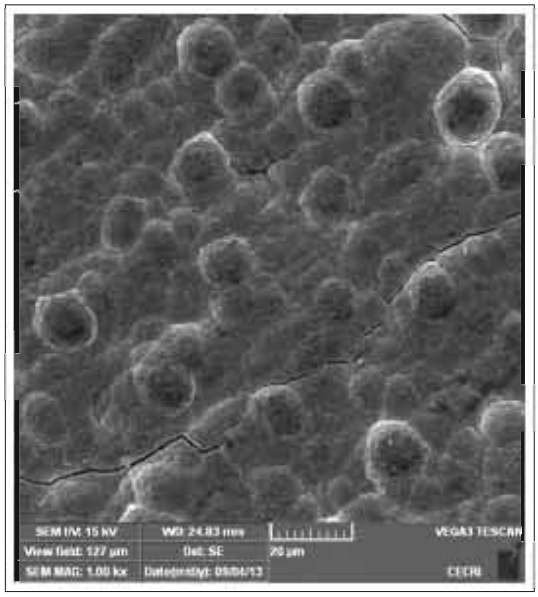
Nickel-coated rebars for macro cell test.

optimized. An 8-µm thick nickel coating exhibited good corrosion resistance in simulated concrete environment with and without chloride ions. In time to cracking study, even though some rust products oozed out from the concrete specimen, no symptom of cracking of concrete was observed even after 100 hours of exposure. Macro cell test and potential time studies are in progress.

- *Thermal barrier organic coatings*: Yttria and zirconia were synthesized by citric acid sol-gel and precipitation methods and characterized by FT-IR, XRD, SEM and TEM. The dispersion stability of yttria as well as functionalization and dispersion stability of zirconia were determined from zeta potential values.
- *Electrodeposited alloy for thermal tests*: A bath was optimized for the electrodeposition of nickel-tungsten alloy on steel and aluminium. Thermal load tests are conducted on 50 and 100 µm thick plates. The 100-µm thick coating on steel protected nearly 18% heat load. Salt spray test showed that it can withstand up to 1000 hours before brown rust formed.



Coating efficiency – steel panel.



SEM of NiW coating.

CSC-0121

Advanced Carbon Materials (ADCARBMATE)

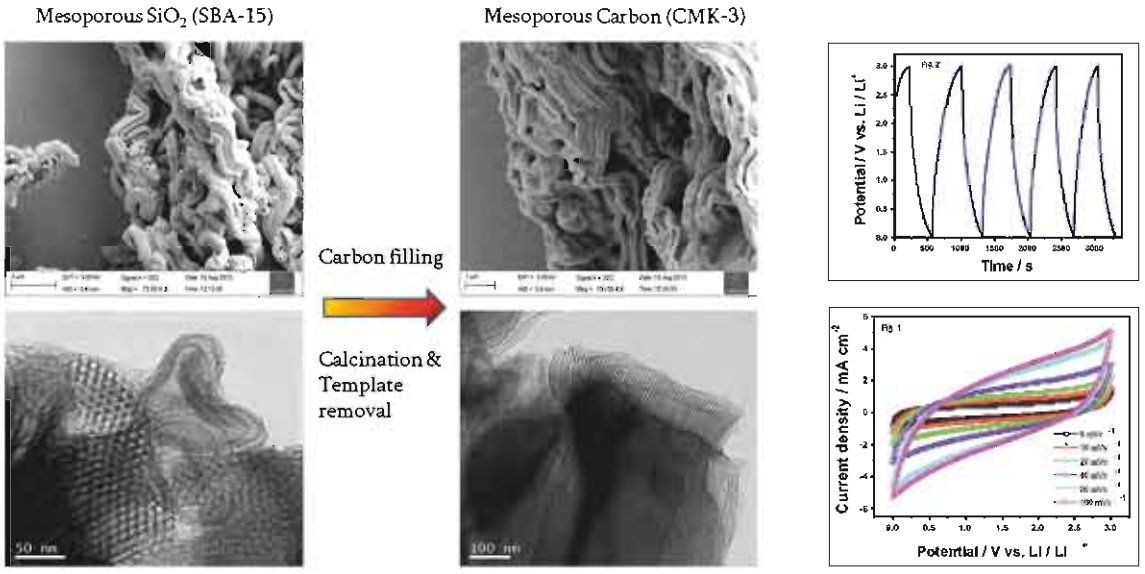
Division involved	: Electrochemical Power Systems Division and Functional Materials
Nodal Officer	: Dr. T. Prem Kumar
Members	: Dr. P. Ragupathy, Dr. N. Lakshminarasimhan and Dr. M. Sathish
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2012 – March 2016
Budget	: Rs 2.5 crore

Objectives

- To investigate the electrochemical properties of carbonaceous materials for applications in batteries and supercapacitors.

Highlights

- Mesoporous carbon (CMK-3) was synthesized by replica synthesis using mesoporous SiO_2 (SBA-15) as a hard template. Carbonization of mesoporous SBA-15 with pores filled with carbon precursor followed by removal of SBA-15 by alkali treatment resulted in mesoporous carbon as a replica of the template. Mesoporous $NiCo_2O_4$ was synthesized by replica method by using SBA-15 as hard template. Composites of CMK-3 with transition metal spinel oxides hold promise in supercapacitor applications.
- Nitrogen-doped graphene (NDG) was synthesized from graphene oxide by hydrothermal process. The structural analysis of the as-prepared NDG was carried out by XRD, FT-IR and Raman spectroscopy. The morphological changes were investigated by FE-SEM and TEM. The electrochemical performance of NDG was evaluated by cyclic voltammetry and constant current charge discharge cycling in a non-aqueous electrolyte. The specific capacitance of NDG was found to be 84 F/g at a current density of 0.5 mA/cm^2.



Mesoporous carbon by hord template method (replica synthesis)

CSC-0122

Design and development of electrodes and electrolytes for water electrolysis to generate hydrogen and hydrogen peroxide for sustainable energy and public hygiene (HYDEN)

Division involved	: Electro-Inorganic and CECRI Chennai Unit
Nodal Officer	: Dr. S. Ravichandran
Members	: Dr. G. Sozhan, Dr. S. Vasudevan and Dr. D. Jonas Davidson
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2012 – March 2017
Budget	: Rs 1.2 crore

Objectives

- Development of non-noble catalyst for water oxidation;
- Development of anion-conducting electrolyte for water electrolysis;
- Design of electrodes for hydrogen and hydrogen peroxide synthesis;
- Development of new membranes for polymer electrolyte fuel cells;
- Development of new electrocatalysts and supports for PEMFCs;
- Techniques for water and thermal management in PEMFCs; and
- Design and development of metallic bipolar plates for PEMFCs.

Highlights

- An MEA was prepared by depositing platinum as a cathode catalyst on Nafion membrane by impregnation reduction method using a non-ionic surfactant and brush coating iridium oxide on the other side of the membrane as anode catalyst. Hydrogen evolution reaction was characterized by linear sweep and cyclic voltammetry. A fine dispersion of the platinum catalyst with reduced particle size and increased electrochemical surface area was achieved when a non-ionic surfactant was used during the impregnation reduction. The uniform dispersion of the platinum catalyst resulted in the reduction of hydrogen evolution potential of the MEA by about 200 mV. Anion-conducting solid electrolyte materials of much lower cost than the Nafion membrane employed by conventional PEM electrolyzer enables an entirely different manufacturing route for water electrolyzer technology. There are some intrinsic benefits in this approach to the conventional method. The anion-conducting solid electrolyte is much cheaper, does not involve any organic polymeric membrane and is free from stringent production steps. CECRI has also developed an AEM suitable for electrolyzer/ fuel cell/capacitor, etc.
- Compared with the other PPO-based systems, the ionic conductivity and IEC values of QPPO are less than those already reported. In spite of this, we are able to achieve a similar performance. This is due to the substitution of chloromethyl groups in the aryl position of the polymer, which increases the distance of interaction between the quaternary ammonium group and oxygen atom of polymer, thus inhibiting the steric hindrance.

CSC-0122

Production amenable processes for polymer electrolyte fuel cell components (HYDEN)

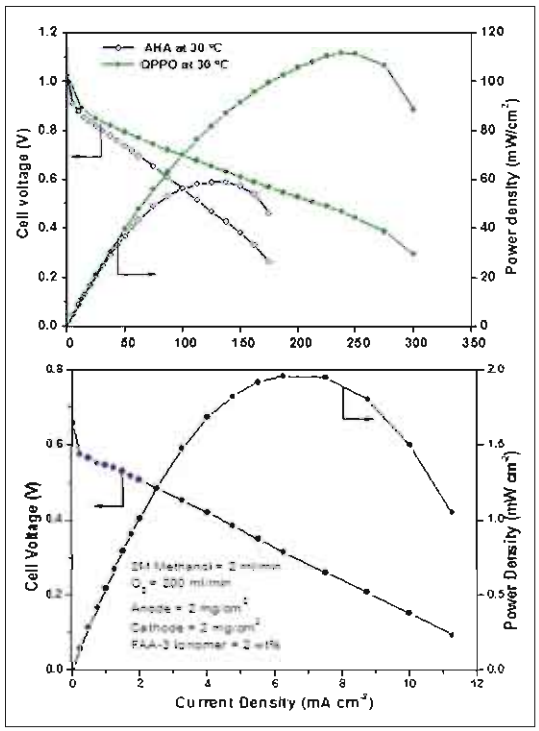
Division involved	: CSIR-CECRI, CSIR-NCL, CSIR-CSMRI
Nodal Officer	: Dr. Santhoshkumar D. Bhat
Members	: Dr. Akhila Kumar Sahu, Mr. V. Venkatesan, Mr. G. Ravichandran, S. Gouse Peera, K. Hari Gopi and A. Arunchander
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2012 – March 2017
Budget	: Rs 4.15 crore

Objectives

- Development of production-amenable processes for polymer electrolyte fuel cell components.

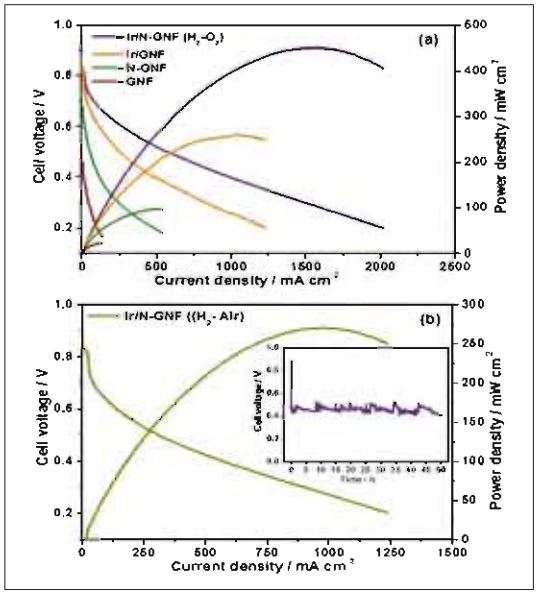
Highlights

- Synthesis of N-doped graphite nanofiber support for Ir nanoparticles as catalyst for enhanced oxygen reduction in polymer electrolyte fuel cells (PEFCs). Anion exchange membrane from poly(phenylene oxide) (PPO)-containing pendant quaternary ammonium groups are fabricated by substituting chloromethyl groups in the aryl position of PPO followed by homogeneous quaternization using a pre-functionalization methodology. Immobilization of dendrimer-encapsulated platinum nanoparticles on ester and active anhydride functionalized carbon as ORR catalyst in PEFCs.
- Preparation of anion exchange membrane (AEM) from poly(2,6-dimethyl-1,4-phenylene oxide) (PPO) through aryl substitution and by using homogenous quaternization for its use in alkaline polymer electrolyte fuel cells. Quaternized-PPO AEM were also explored for alkaline DMFCs. The membrane electrolyte exhibited an enhanced performance in comparison with a state-of-the-art commercial AHA membrane. A peak power density of 111 mW/cm^2 at a load current density of 250 mA/cm^2 was obtained for PPO-based membrane in APEFCs at 30°C. The optimized QPPO membrane also showed comparable stability in relation to AHA membrane at OCV conditions.

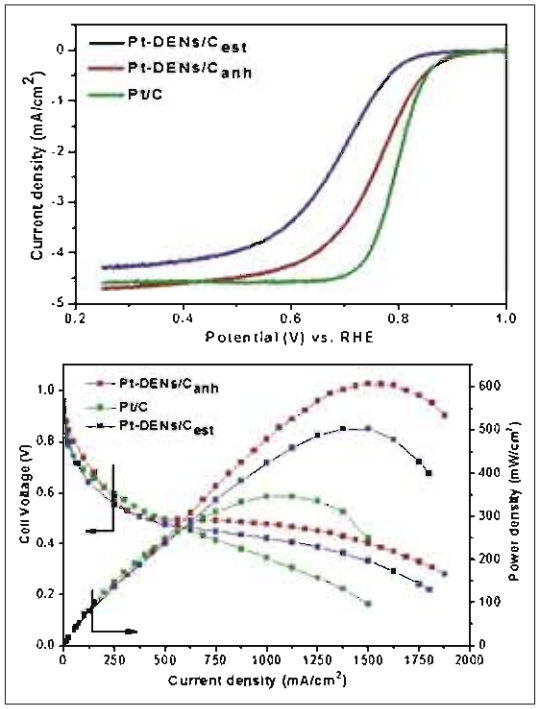


- Nitrogen functionalization of graphite nanofibers was performed using hexamethyltetra amine (HMTA) as the nitrogen source and used as a support material for Ir metal particle deposition and

explored for enhanced ORR in PEFCs. The PEFC with Ir/N-GNF catalyst delivered a peak power density of 450 mW/cm^2 at a load current density of 1,577 mA/cm^2, while the PEFC with Ir/GNF catalyst delivers a peak power density of only 259 mW/cm^2 at a load current density of 1,040 mA/cm^2 under identical operation conditions.

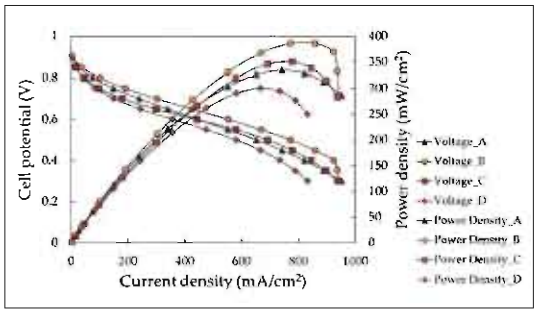


- Pt nanoparticles were encapsulated in fourth-generation amine-terminated poly (amidoamine) (PAMAM) dendrimer (G4-NH2) and immobilised onto ester and anhyride functionalised carbon supports. While analysing the catalysts for ORR, the improved onset potential for Pt-DENs/Canh indicated higher catalytic activity in relation to the Pt-DENs/Cest. Electrochemical studies showed that Pt-DENs/Cest and Pt-DENs/Canh exhibited catalytic activity towards ORR. PEFCs with Pt-DENs/Cest and Pt-DENs/Canh as the cathode catalyst showed significant performance in comparison with Pt/C synthesised under the same condition.
- The evaporative cooling concept was used in LT-PEMFC in order to achieve coupled water and thermal management. Water and thermal management technique was developed for a 100 cm^2 cell using Wick-based evaporation in PEMFCs. System complexity was greatly reduced since it obviated the need for any humidification unit in PEMFCs.



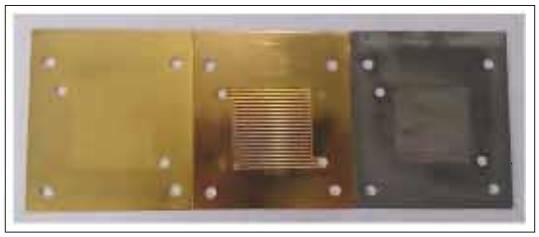
Configurations	Anode	Cathode	Humidification	
			Anode	Cathode
A	Without Wick	Without Wick	External	External
B	Wick with Trough	Without Wick	In situ	External
C	Without Wick	Wick with Trough	External	In situ
D	Wick With Trough	Wick With Trough	In situ	In situ

Different configurations studied for single cell setup.

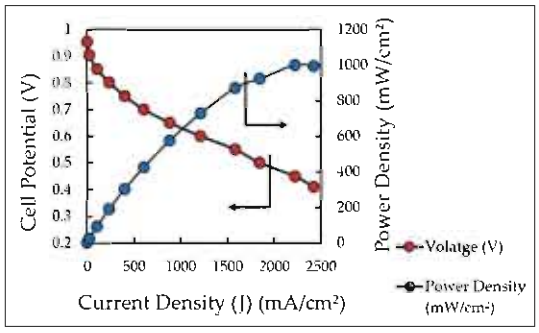


Polarization curves for different single cell configurations tested with acetone treated carbon cloth and co-flow approach.

- Cost-effective, low-weight metallic bipolar plates are aimed to be developed by means of stamping of SS316L plates. Metallic bipolar plates were designed and developed for its use in PEMFCs. Gold-coated metallic bipolar plates in PEMFCs showed better performance than traditional graphite plates for single cell setup. EIS was used to check the resistance of the plates. The resistance of gold-coated metallic plate was less in comparison with graphite plates.



Coated SS plates: TiN; gold; and plasma nitride.



Polorization and power density curve for PEMFC with gold-coated metal plate.

CSC-0129

A multi-scale simulation and modeling approach to designing smart functional materials for use in energy, electrochemistry and bio-mimetics

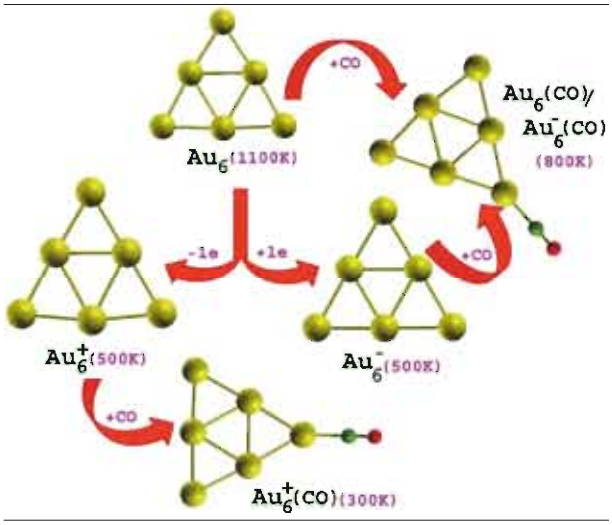
Division involved	: Functional Materials
Nodal Officer	: Dr. Sailaja Krishnamurty
Members	: Dr. P.Murugan and Dr. A. Paul
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2012 – March 2017
Budget	: Rs 1.70 crore

Objectives

- To explore, by means of quantum mechanical methods, means of storing hydrogen, both through physico- and chemisorption methods;
- Understanding electrochemical interfaces such as cathode/solid state electrolyte and anode/electrolyte by multi-scale simulation approach;
- Modeling and simulation of nucleation and growth of solids in electrochemical devices;
- Functionalisation of different polypyridine complexes for electrochemical sensor using quantum chemical methods and quantification of their response towards the NO adsorption; and
- Exploration of nano-catalysts for the cathode of DMFC using a combination of quantum chemical and molecular mechanics methods.

Highlights

- Functionalization was studied; study of NO response is in progress. Several nano-catalysts were identified for potential studies using QM-MM.



- Conformation and electronic charge on a gold cluster are known to determine its catalytic property. However, little is known on the finite temperature behavior of various gold cluster conformations. Much less is known on the role of charge or a ligand in stabilizing a conformation at finite temperatures. In this work, we have carried out relativistic DFT-based molecular dynamical simulations on neutral and charged Au_6 clusters with an aim of understanding the stability of ground state conformations as a function of charge on the cluster. Our simulations reveal that cationic and anionic Au_6 clusters undergo conformational transitions at 500K where as neutral Au_6 cluster retains its ground state conformation up to a temperature of 1,100K. In order to look into the factors leading to the stabilization of neutral Au_6 cluster (or destabilization of cationic and anionic Au_6 clusters), structural and electronic properties are analyzed. Factors such as charge redistribution within the atoms and composition of molecular orbitals are seen to contribute towards stronger Au–Au bonds in Au_6 thereby stabilizing it considerably. Following the analysis, simulations are also extended to neutral, cationic, and anionic Au_6–CO_n (n = 1,2) complexes. In the case of CO chemisorbed Au6 clusters, neutral and negatively charged ground state conformations are stable up to nearly 800K, while the positively charged Au_6 ground state conformation collapses at room temperature. This work, in short demonstrates how charge or even a ligand can be used to moderate the physical properties of a gold cluster.

CSC-0132

Sustainable technologies for utilization of rare earths (SURE)

Division involved	: Electro-Pyrometallurgy
Nodal Officer	: Dr. L. John Berchmans
Members	: Dr. S. Angappan, Dr. G. Sreedhar and Dr. S. Mohan
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2012 – March 2017
Budget	: Rs 3.02 crore

Objectives

- Development of indigenous processes for the conversion of rare earth minerals into value-added products;
- Utilization of Indian rare earth mineral resources for the preparation of rare earth-based metals and alloys;
- Preparation of lanthanum–nickel and neodymium–iron alloys by molten salt electrolysis.

Highlights

- Recent interest is focused on the development of new metals and inter-metallic alloys for hydrogen storage in energy conversion systems. AB_5 type hydrogen storage alloys were found to perform better than the other materials. La-Ni alloys have been proposed as a hydrogen storage medium in the nickel metal hydride (Ni–MH) batteries because of their better properties. Considering the importance of these materials in the field of energy conservation, attempts were made to prepare these materials by molten salt electrolysis. La-Ni alloy was prepared using melts of $LaCl_3$/LiCl–KCl. Nickel tubes or rectangular plates were used as the cathode. A high-purity graphite rod was used as the anode. An Inconel reactor was used for the electrolysis. Trials were performed at different current densities ranging from 0.75 to 1.25 A/cm^2 at 630°C. La was deposited at the Ni cathode forming molten La-Ni alloy. The deposited alloy was characterized using XRD, EDAX and SEM. XRD data revealed the crystallinity of La-Ni alloy. EDAX spectrum exhibited the disproportionate concentration of La and Ni in the deposited alloy. A lower percentage of Ni in the alloy may be due to insufficient dissolution of Ni during the electrolytic process. SEM images showed serrations and nodules on the alloy surface, which may be due to thick oxide layers. The process has been developed on laboratory scale up to 75 A capacity.

Molten salt reactor.

CSC-0134

Molecules to materials to devices (M2D)

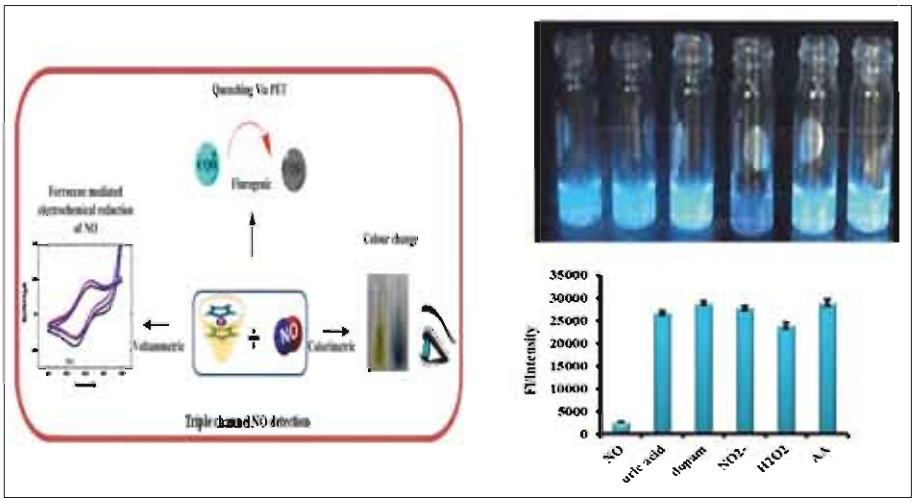
Division involved	: Electrodics and Electrocatalysis – Biosensors; Electrodics and Electrocatalysis – Nanomaterials; Electrochemical Materials Science; and Electro-Organic Chemicals
Nodal Officer	: Dr. Sheela Berchmans
Members	: Dr. A. Palaniappan, Dr. V. Ganesh, Dr. M. Murugesan, Dr. J. Mathiyarasu, Dr. James Joseph, Dr. C. Sivakumar, Dr. S. Senthilkumar, Dr. B. Subramanian, Dr. R. Thangamuthu, Dr. Subrata Kundu, Dr. S.M. Senthil Kumar, Dr. M. Jayachandran and Dr. M. Anbu Kulandainathan
Sponsor	: Council of Scientific and Industrial Research
Duration	: February 2013 – March 2017
Budget	: Rs 2.44 crore

Objectives

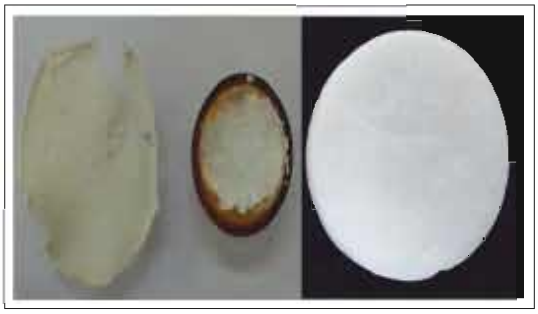
- Electrochemical sensor platforms for human healthcare and environment monitoring;
- Materials and devices related to electrochemical diagnostic applications;
- Development of bio-active glassy metals coated implants and anti-microbial active nanoparticle-immobilized fabrics for human healthcare; and
- Nanomaterials/fluorosilane polymers for functionalised fabrics.

Highlights

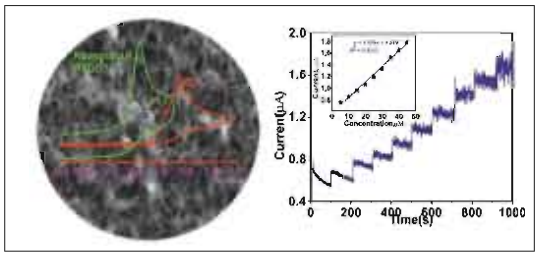
- *Triple-channel detection of NO*: Preparation of NO-releasing scaffolds for wound healing and anti-bacterial applications. Selective detection of NO was demonstrated up to nM using colorimetric, amperometric and fluorogenic detections using the single chemical entity ferrocene. NO-releasing scaffolds that can release nitric oxide of the order of ~65 nM/min were prepared for anti-



Triple-channel detection of NO.

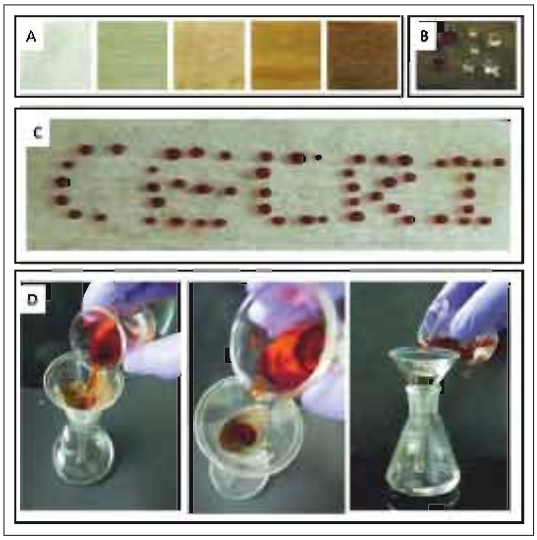


NO-releasing chitosan–alginate scaffolds.

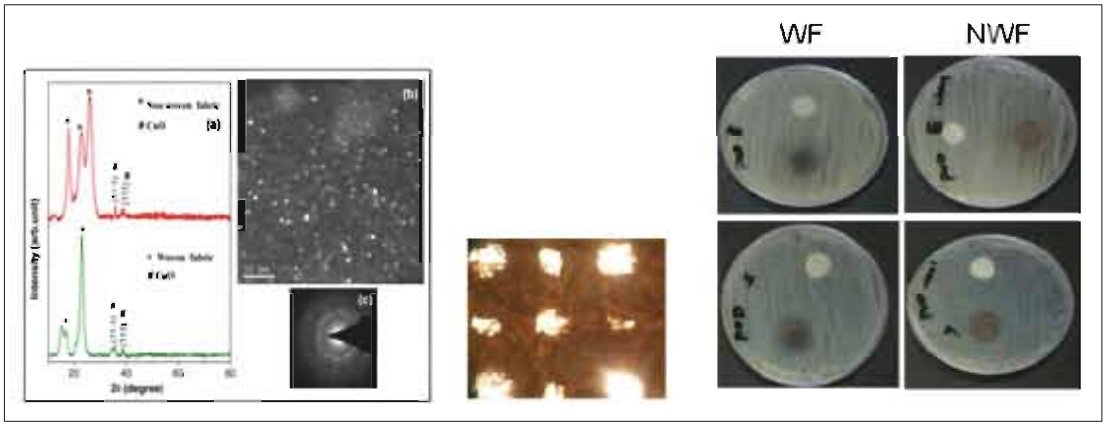


Nanoporous poly(3,4-ethylenedioxythiophene)-modified glassy carbon electrode for the oxidation of NADH at low overpotentials.

microbial and wound healing applications. Materials for electrochemical detection of cholesterol and bilirubin. The influence of co-electrodeposited gold particles on the electrocatalytic properties of CoHCF thin films was evaluated. Electrocatalytic oxidation of NADH at low overpotential using nanoporous poly(3,4-ethylenedioxythiophene) modified glassy carbon electrode. Preparation of graphene nanoflakes (GNF) and their application for electrocatalytic oxidation of hydrazine. Hemoglobin detection using robust polymer-embedded gold atomic clusters. Aminosiloxane-stabilized CdS QD for Ag^+ optical sensing. Construction of an Au_{nano}-POT/rGO biosensor. $Zr_{48}Cu_{36}Al_8Ag_8$ thin film metallic glass. CuO-impregnated fabric for anti-icrobial activity. Super-hydrophobic cellulose for oil–water separation. Release of nAg for wound healing application from polymer grafted nAg-impregnated cellulose surfaces and their anti-microbial properties. Preparation of thermally responsive rayon modified with polypyrrole.



Super-hydrophobic fabric for oil/water separation.



CuO-sputtered fabric for antimicrobial activity.

ESC-0110

Innovative technologies for health assessment and damage mitigation of structures (I-HEAL)

Division involved	: Corrosion and Material Protection
Nodal Officer	: Dr. K. Thangavelu
Members	: V. Saraswathi, SP. Manokaran, K. Saravanan, S. Muralidharan, A. Madhavamayandi, M.S. Karthikeyan
Sponsor	: Council of Scientific and Industrial Research
Duration	: 2013 - 2017
Budget	: Rs 145.6 lakh

Objectives

- To develop innovative approaches to remove the restrictions in the earlier techniques for non-destructive and electrochemical methods for condition assessment and strategies for automatic data collection for forensic analysis of bridges and structures.

Highlights

- Corrosion monitoring of rebars embedded in concrete was carried out using dielectric spectroscopic technique. In this technique, very low and high frequencies are impressed on rebars embedded in RCC specimens and the response is monitored. From this response, the corrosion rate of rebar can be assessed so as to quantify the rate of corrosion of rebars embedded in concrete. RCC specimens were subjected to alternate wetting and drying with 3% NaCl solution and distilled water, so as to study the behaviour of rebar in aggressive and normal environmental conditions. Encouraging results have been acquired and periodic monitoring is in progress.
- Corrosion monitoring of 7 mm prestressing steel wires embedded in prestressed concrete beams are in progress. Based on the resistance principle, corrosion was monitored on the prestressing steel wires. Prestressed concrete beams were subjected to alternate wetting and drying with 3% NaCl solution and distilled water, so as to study the behaviour of prestressing steel wires in aggressive and normal environmental conditions. Periodic corrosion monitoring is in progress.

ISC-102

CSIR Knowledge and gateway and open source private cloud infrastructure (KNOWGATE)

Divisions involved	: Computer Networking Unit; and Technology Transfer and Business Development
Nodal Officer	: Dr. G. Radhakrishnan
Members	: Dr. N. Meyappan
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2012 - March 2017
Budget	: Rs 5.125 lakh

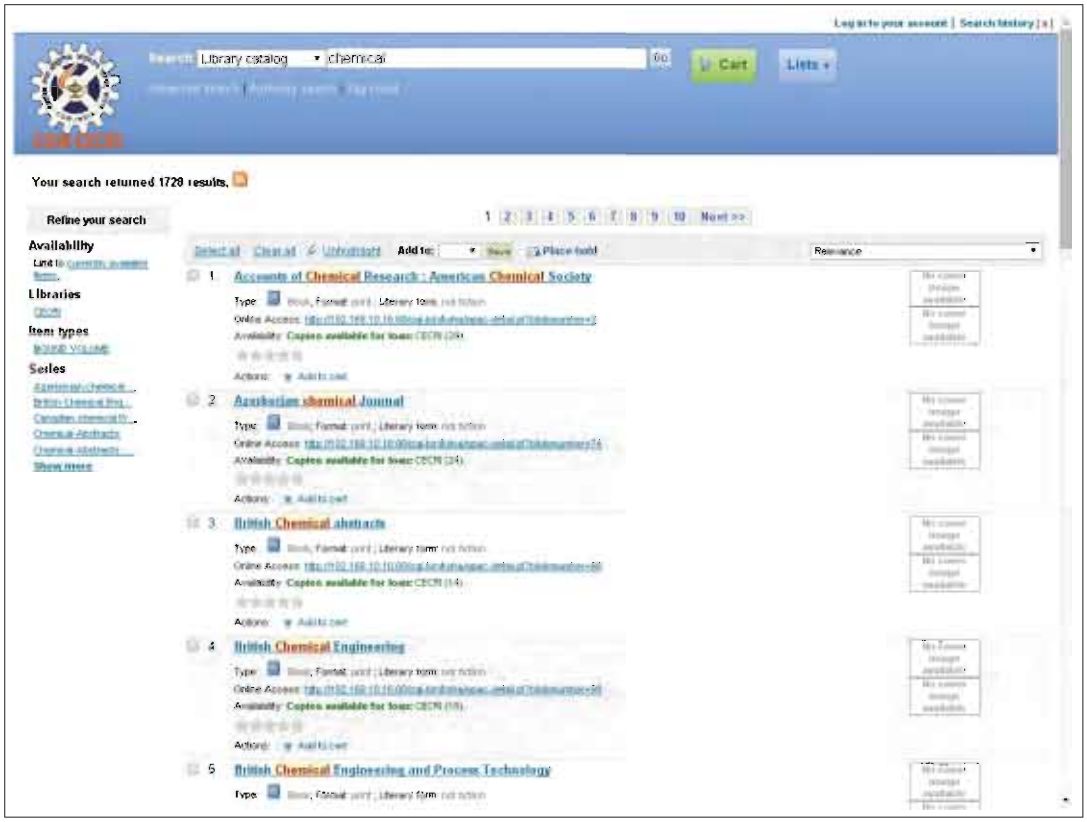
Objectives

- To setup a cloud infrastructure that can be accessed as a service from any CSIR laboratory; this platform will be used by individual Knowledge Resource Centers (KRCs) of CSIR laboratories for their computational needs;
- To establish a small Open Source Software Technology Solution Cell (OSSTSC); this will provide an Open Source Software (OSS) solution for library automation, institutional repositories/digital libraries and network security and management;
- To create CSIR distributed library/virtualized union Open Public Access Catalogue (OPAC) of CSIR holdings using Z39.50 protocol and open source integrated library management software KOHA. This will allow federated search on CSIR knowledge resources; and
- To provide multi-dimensional analysis system to analyse CSIR research, technology and related data. The above objectives are accomplished by the three modules, viz., CSIR Cloud, CSIR Cat and CSIR Trend developed and deployed by CSIR-NISCAIR.

Highlights

- *Installation of Linux and KOHA*: CentOS (abbreviated from Community Enterprise Operating System) version 6.3 x86 was installed. It is a Linux distribution that attempts to provide a free, enterprise class, community-supported computing platform. An open source integrated library management software KOHA was installed. KOHA is a full featured Integrated Library System (ILS) and it is based on client-server architecture. KOHA accommodates low-bandwidth connections and it runs over TCP-IP network. The KOHA has the following features: simple, clear interface for librarians and members (patrons); various Web 2.0 facilities like tagging, comment, social sharing and RSS feeds; union catalog facility; customizable search; circulation and borrower management; full acquisitions system including budgets and pricing information; ability to cope with any number of branches, patrons, patron categories, item categories, items; serials system for magazines or newspapers; reporting; and reading lists for members.
- *Data migration*: KRC at CECRI was using Integrated Library Management Software (ILMS) Libsys, which is proprietary software. The existing book holdings (25,275 records) were cleansed, converted to MARC format and migrated to the KOHA server. For conversion of MARC format, MarcEdit software was used, which is a Windows-based software program for editing and manipulating MARC data.
- *Rollout of OPAC*: As part of the CSIR-CAT Module deployment, an OPAC was successfully installed for federated search

using Z39.50 protocol. Presently the OPAC is deployed in the private network of CSIR-CECRI (intranet) and is accessible at http://192.168.10.16



PSC-0101

Development of electroplating, electroforming and electropolishing of microwave tube components (MTDDC)

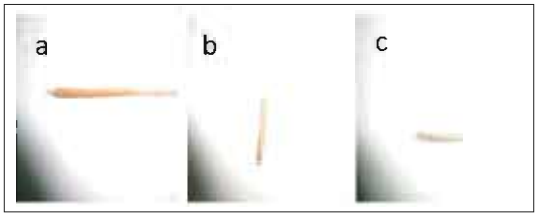
Divisions involved	: Electrochemical Metal Finishing
Nodal Officer	: Dr. S. Mohan
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2013 – March 2017
Budget	: 75.760 lakh

Objectives

- Development of electroplating, electroforming and electropolishing of MW tube components.

Highlights

- Microwave (MW) tubes are an extremely important class of electronic devices whose different types find applications in communication satellites, RADARs, high energy physics experiments and nuclear particle accelerators, medical LINACs for radiation therapy, industrial LINACs, container scanners and plasma heating for fusion energy research. R&D on MW tubes has received a big boost in recent past due to enhancement in their capabilities in terms of pulse power, average power, efficiency, higher operating frequencies and reliability in order to meet the requirements of their newly emerging applications in the following major fields: particle accelerators, thermonuclear fusion energy research, satellite communication, terahertz imaging, etc. *e.g.* Klystron generating CW power in the range of 100 kW to 1 MW at 352.2 MHz frequency are required for RF systems used in Accelerator driven sub-critical systems being planned by Department of Atomic Energy. Others types of Klystrons such as, those generating 250 kW CW power at 5 GHz are being projected for the RF systems of different accelerators and plasma heating systems for industrial and medical applications. The International Thermonuclear Experimental Reactor project, in which India is one of the partners, has requirement of 24 MW CW power at 170 GHz to be met out of Gyrotrons. Similarly, Ka-band high efficiency (60%), high reliability TWT with 100 W CW power and 50 dB gain is required for satellite communication applications. The high power (40 kV/5 kA) pseudo spark switches have potential requirements for the development of very high power pulse modulators being used at BARC and IPR and other institutions in the country. High power MW tubes are also used for vital strategic applications. We have completed electroplating of gold on helix and CEERI (Pilani) has carried out the relevant tests



Electroplating of helix made of W-97% - Re-3 tape with gold. (a) electroplated helix sample before firing; (b) electroplated helix sample after vacuum firing at 700°C and (c) electroplated helix sample after hydrogen firing at 700°C.

PSC-0109

Development of advanced materials for next generation energy efficient devices (D-NEED)

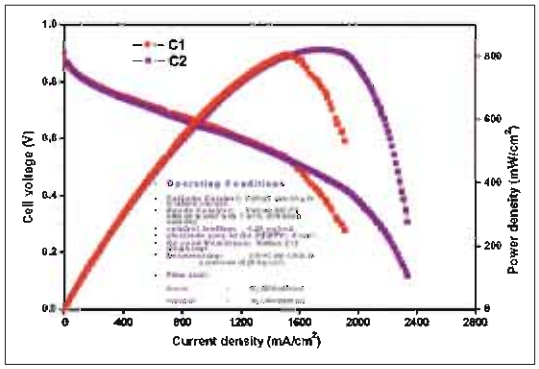
Divisions involved	: CSIR-CECRI and CSIR-NPL
Nodal Officer	: Dr. Akhila Kumar Sahu
Members	: Dr. Santoshkumar D. Bhat
Sponsor	: Council of Scientific and Industrial Research
Duration	: April 2012 – March 2017
Budget	: Rs 7.5 lakh

Objectives

- Evaluation of carbon papers and carbon support materials in PEM fuel cells.

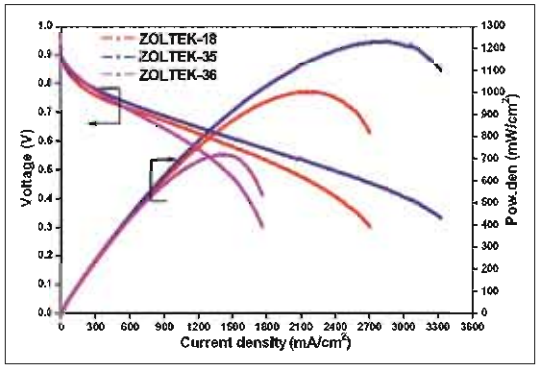
Highlights

- The potential of graphite nanofiber (GNF)-poly(3,4-ethylenedioxythiophene) (PEDOT) composite was explored as a catalyst support for polymer electrolyte fuel cells (PEFCs). Due to electron accepting nature of GNF and electron donating nature of PEDOT, the monomer EDOT adsorbs on the surface of GNF due to strong electrostatic interaction. Pt nanoparticles were impregnated on GNF-PEDOT composite by ethylene glycol reduction method and their effects on electrocatalytic activity for ORR were studied. Pt particles supported on GNF-PEDOT with a catalyst loading of 0.2 mg/cm^2 exhibited a peak power density of 537 mW/cm^2 at a load current density of 1,120 mA/cm^2, while it was only 338 mW/cm^2 at 720 mA/cm^2 in the case of Pt particles supported on pristine GNF.
- *Optimization of Pt supported on CNT as electrocatalysts in PEFCs*: Pt/CNT-based samples were optimized based on the half cell and Fuel cell studies. C-series (C1, C2 and C3) samples showed higher performance in comparison to other series (E, Ar, N, M and CZ) samples. C-series samples delivered peak power density of 800 mW/cm^2, while peak power density of 450 mW/cm^2 was obtained for the PEMFC employing N-series sample at 60°C H_2 and O_2.



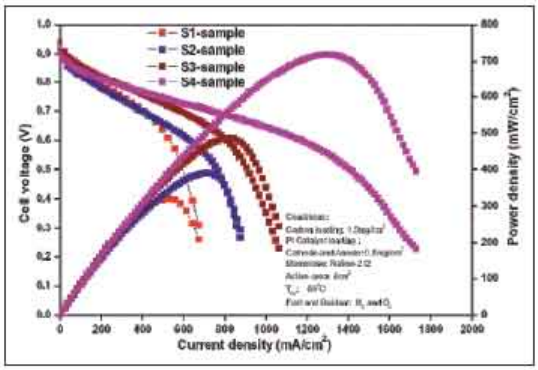
PEFC performance of Pt/CNT-based catalysts (C series) at 60°C with H_2 and O_2.

- *Optimization of poraus carbon papers for electrochemical studies in PEFCs*: ZOLTEK carbon papers and porous carbon papers (S1, S2, S3 and S4) were evaluated as electrodes in PEMFCs. ZOLTEK carbon papers showed higher fuel cell performance in comparison to



PEFC performance for ZOLTEK carbon papers at 60°C with H_2 and O_2.

S1, S2, S3 and S4 series of porous carbon papers. ZOLTEK-35 delivered peak power density of 1.23 W/cm^2 for the PEMFC at 60°C employing H_2 as fuel and O_2 as oxidant.



PEFC performance for S series carbon papers at 60°C with H_2 and O_2.


CSIR
GRANT-IN-AID PROJECTS
CECRI

ICP-MS X Series 2 (Thermo Electron)

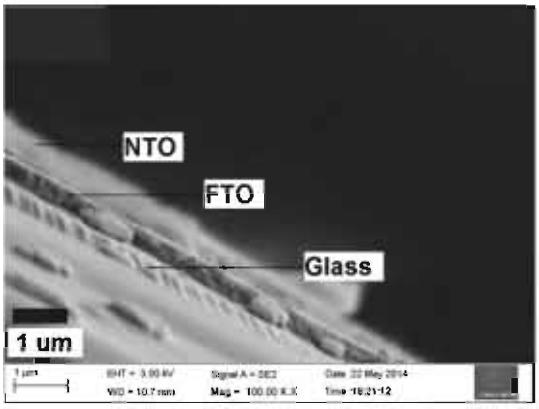
GAP-22/10

Soft chemical strategies for the synthesis of indium-free nanocrystalline transparent conducting oxides

Division involved	: Functional Materials
Nodal Officer	: Dr. N. Lakshminarasimhan
Sponsor	: Department of Science and Technology
Duration	: February 2011 – February 2014
Budget	: Rs 24.2 lakh

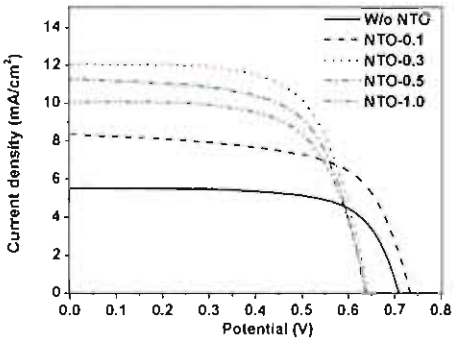
Objectives

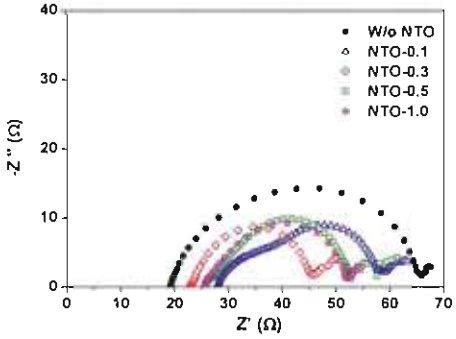
- To synthesize and characterize nanocrystalline Al-doped ZnO and Nb-doped TiO_2;
- To coat the synthesized materials by spin coating/dip coating on glass substrate; and
- To evaluate TCO-coated glass electrodes.



Highlights

- TiO_2:Nb deposited over FTO glass exhibited enhanced DSSC performance by acting as a blocking layer that prevents back electron transfer. The efficiency was found to be the highest (5.10%) when Nb content was (0.3 mol.%).





GAP-14/11

On the dual electrode behavior of certain $Li_yM_xO_4$ (X = Sn, P) compounds: An explorative attempt on a new concept

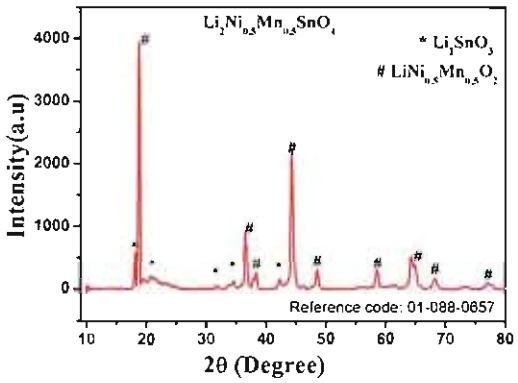
Division involved : Electrochemical Power Systems
Nodal Officer : Dr. N. Kalaiselvi
Co-Nodal Officer : Dr. P. Periasamy
Budget : Rs 29.87 lakh

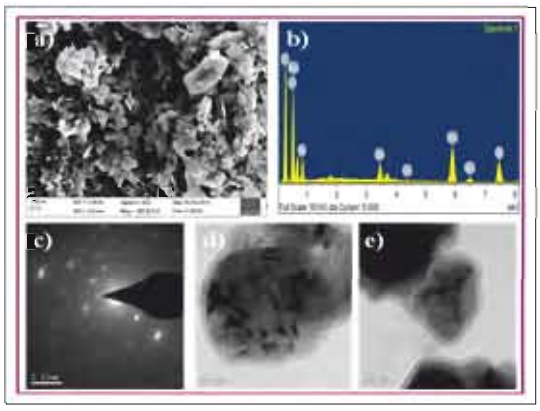
Objectives

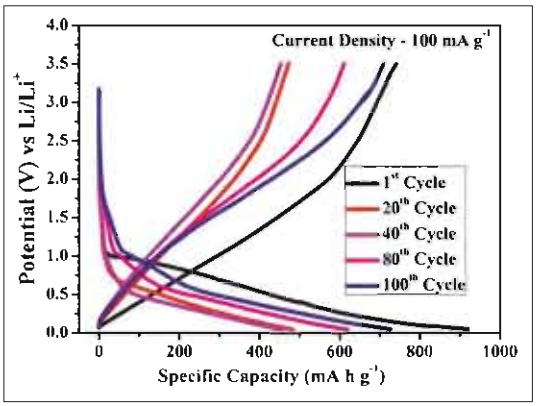
- Adoption of different methods to synthesize $Li_yM_xO_4$ (X = Sn, P) compounds;
- Surface and/or electronic modification of the products to improve lithium intercalation behavior;
- Understanding synthesis-structure-property relationship, applicable to cathode, anode and dual electrodes pertinent to the Li_yMXO_4 (X = Sn, P) family;
- Selection of better performing electrode material as cathode, anode and dual electrode individually from the chosen compounds; and
- Demonstration of dual electrode behavior of shortlisted compounds and their futuristic application in lithium batteries.

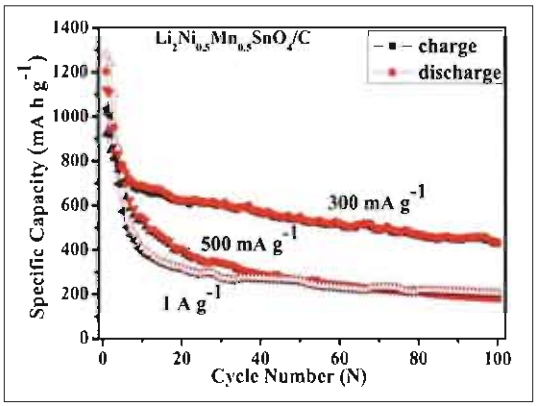
Highlights

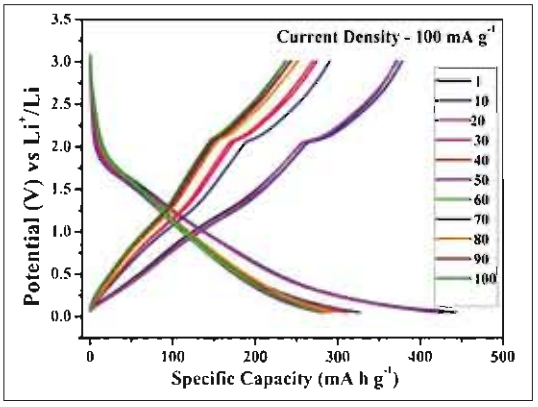
- A new combination of $Li_2Ni_{0.5}Mn_{0.5}SnO_4$/C was synthesized, which was found to exist as a hybrid. Upon exploration as anode, the composite demonstrates as yet another promising candidate for use in lithium batteries. An initial capacity of 950 mAh/g and 730 mAh/g after 100 cycles were obtained with an acceptable fade of <10% after completing 100 cycles. Excellent physical and electrochemical properties were observed for ODH-assisted combustion synthesized $LiVP_2O_7$/C composite. An initial capacity of 435 mAh/g and 300 mAh/g after 100 cyles with an acceptable fade were obtained with $LiVP_2O_7$/C composite anode.

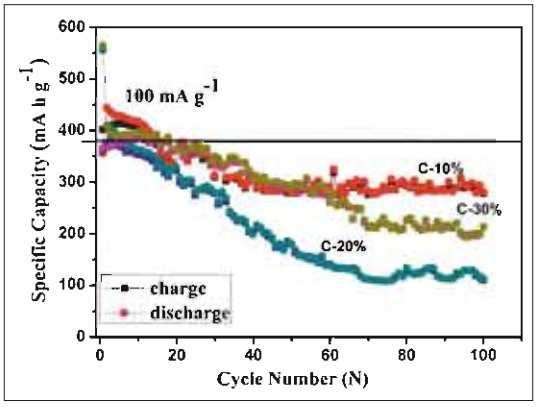


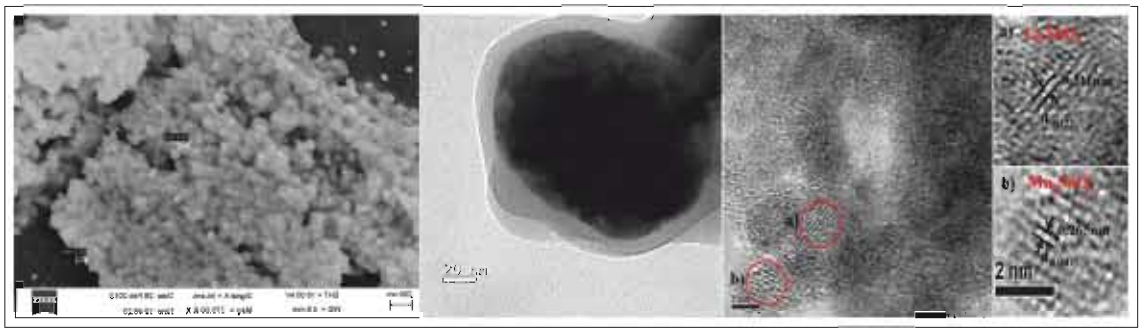



Current Density - 100 mA g-1
Potential (V) vs Li/Li+
Specific Capacity (mA h g-1)
1st Cycle
20th Cycle
40th Cycle
80th Cycle
100th Cycle


Li2Ni0.5Mn0.5SnO4/C
charge
discharge
300 mA g-1
500 mA g-1
1 A g-1
Specific Capacity (mA h g-1)
Cycle Number (N)


Current Density - 100 mA g-1
Potential (V) vs Li+/Li
Specific Capacity (mA h g-1)


100 mA g-1
C-10%
C-30%
C-20%
charge
discharge
Specific Capacity (mA h g-1)
Cycle Number (N)


2 nm

GAP-06/12

New polymer electrolyte membranes for direct methanol fuel cells

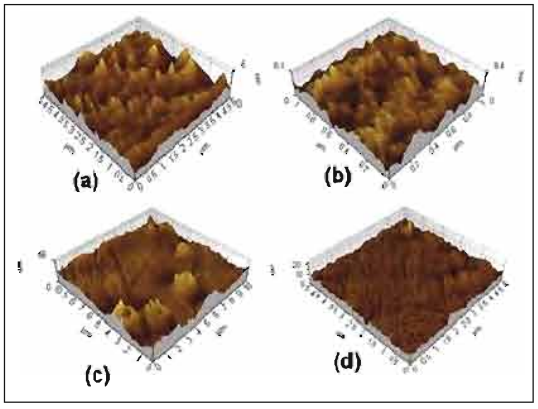
Division involved : CECRI-Chennai Unit
Nodal Officer : Dr. Santoshkumar D. Bhat
Sponsor : Department of Science and Technology
Duration : July 2012 – July 2015
Budget : Rs 20.05 lakh

Objectives

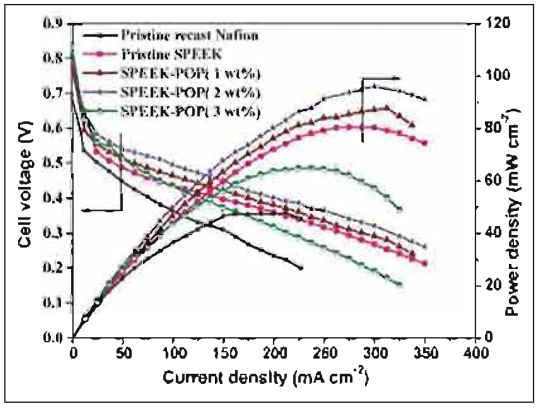
- Fabrication of proton conducting and methanol impermeable membranes for DMFCs.

Highlights

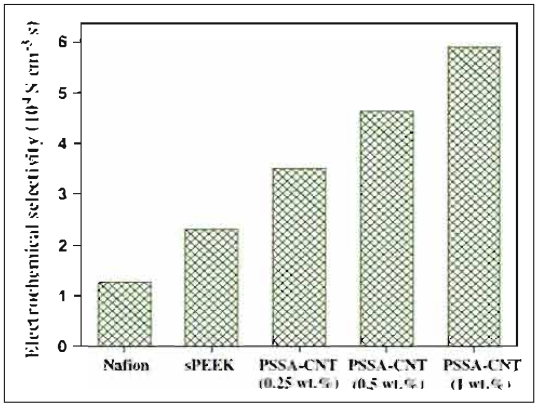
- Sulfonated poly ether ether ketone (sPEEK) was modified with organic/inorganic additives for its effective use in DMFC. The first attempt was the fabrication of blend membranes of sPEEK and POP. The incorporation of POP affects the ionic channels of sPEEK thereby reducing the methanol permeability without affecting the proton transport through the membrane. Mixed matrix membranes based on zeolite 4A, methane sulfonic acid (MSA)-sPEEK were evaluated as potential polymer electrolyte membranes for DMFCs. Mixed matrix membranes showed high electrochemical selectivity thereby enhancing the DMFC performance on par with Nafion-117. Partial molecular sieving effect of zeolite 4A seems to be helpful in restricting the methanol permeability of the mixed matrices.
- A novel composite membrane for DMFCs was prepared by incorporation of polystyrene sulfonic acid (PSSA)-functionalized MWCNTs into sPEEK matrix. Increased ionic conductivity and methanol barrier properties of the composite proved to be beneficial in improving the overall DMFC performance. Composite membranes of sPEEK-PSSA-CNTs are stable in the cell mode operation and hence long term use of this composite membrane as PEM for DMFCs appears realistic.



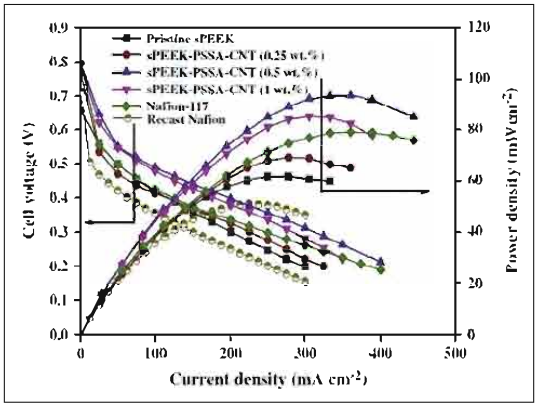
AFM topological images for (a) pristine SPEEK, (b) SPEEK-POP (1 wt%), (c) SPEEK-POP (2 wt%) and (d) SPEEK-POP (3 wt%) blend membranes.



Performance curves for DMFCs with pristine recast Nafion, pristine SPEEK and blend membranes of SPEEK at 60°C.



Electrochemical selectivity for recast Nafion, pristine sPEEK and composite membranes of sPEEK–PSSA–CNTs.



DMFC cell polarization for Nafion, pristine sPEEK and composite membranes of sPEEK–PSSA–CNTs.

GAP-05/12

Development of Li-ion supercapacitor as smart and clean energy storage devices

Division involved	: Fuel Cells
Nodal Officer	: Dr. P. Ragupathy
Sponsor	: Department of Science and Technology
Duration	: July 2012 – July 2015
Budget	: Rs 21.7 lakh

Objectives

- Development of lithium-ion capacitor and fundamental understanding of the active materials.

GAP-07/12

Synthesis of size and shape controlled ZnO and TiO_2 nanomaterials for dye-sensitized solar cell (DSSC) applications

Division involved	: Electrochemical Materials Science
Nodal Officer	: Dr. Subrata Kundu
Sponsor	: Department of Science and Technology
Duration	: August 2012 – July 2015
Budget	: Rs 19.7 lakh

Objectives

- To synthesize oxide-based nanomaterials with controlled shape and size; and
- To characterize them for possible application in DSSCs. The focus is on the synthesis of ZnO and TiO_2 nanomaterials by wet-chemical, UV-photoactivation, and microwave heating methods. The size and shape of the nanomaterials will be tuned by altering synthetic conditions that control nucleation and growth. The potential of the nanomaterials for solar cell application and catalysis reactions will be examined. The capability of fabricating oxide nanomaterials at ambient condition in room temperature with arbitrary topology will offer interesting opportunities for future photovoltaic, device applications and in catalysis.

Highlights

- A facile route for the formation of shape-selective ZnO nanoarchitectures was demonstrated. ZnO nanostructures assembled by low-dimensional building blocks were synthesized and the size and shape of the nanomaterials tuned by altering the starting reagents molar ratios and changing other reaction parameters. The procedure generated different shapes (bacteria-like, larva-like, flake-like and flower-like) in short time scales.
- A new route for the formation of wire-like clusters of TiO_2 nanomaterials self-assembled in DNA scaffold within an hour reaction time was demonstrated. TiO_2 nanomaterials were synthesized by reaction of titanium-isopropoxide with ethanol and water in the presence of DNA under continuous stirring and at 60°C. The individual size of the TiO_2 NPs self-assembled in DNA and the diameter of the wires could be tuned by controlling the DNA to Ti-salt molar ratios and reaction parameters. The eventual diameters of the individual particles were 15±5 nm ranges whereas the length of the nanowires were in the 2–3 µm range. The wire-like DNA-TiO_2 nanomaterials were found to be suitable for electrochemical supercapacitor and DSSC applications.

GAP-08/12

Electrochemical investigation of graphene oxide and graphene-metal/transition metal oxide nanocomposites

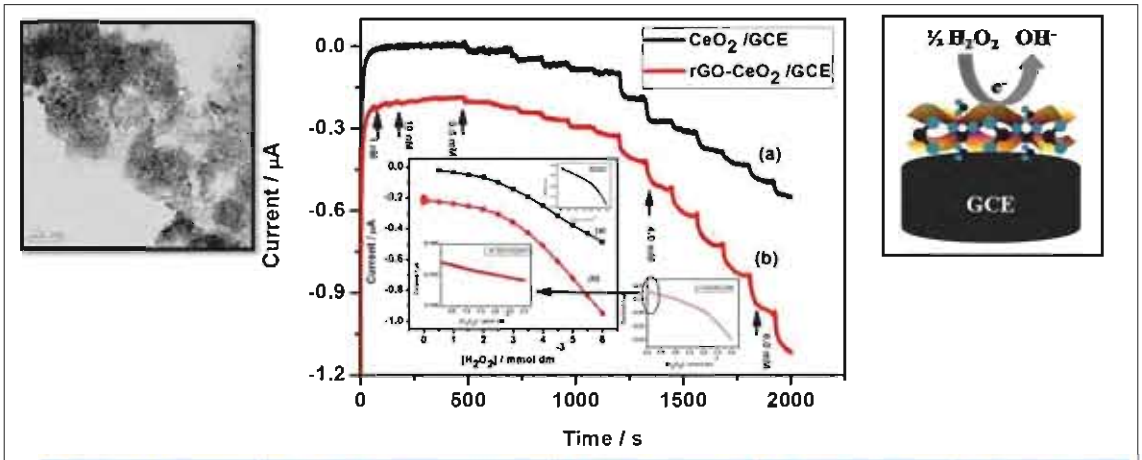
Division involved	: Electroplating and Metal Finishing Technology
Nodal Officer	: Dr. Shailendra Kumar Jha
Sponsor	: Department of Science and Technology & Council of Scientific and Industrial Research
Duration	: July 2012 – July 2015
Budget	: Rs 2.0 lakh

Objectives

- To synthesize nanostructured materials for sensing and energy applications

Highlights

- A 3-D porous CeO_2/reduced graphene oxide xerogel composite catalyst was formulated and used for non-enzymatic sensing of hydrogen peroxide, which is extremely important in the field of food industry, and in pharmaceutical, clinical, industrial and environmental analyses.



Electrode materials	Sensitivity	Linear range	Detection limit	Working Potential/V
CeO_2/rGO/GC	1.978×10^{-4} μA/μM	60.70 nM–3.0 μM	30.40 nM	-0.3 V
CeO_2/GC	2.9346×10^{-5} μA/mM	91.88 μM–2.0 mM	31.29 μM	-0.3 V

Electrochimica Acta 120 (2014) 308–313

GAP-09/12

Revisit of cathodic protection potential requirement to update the guideline

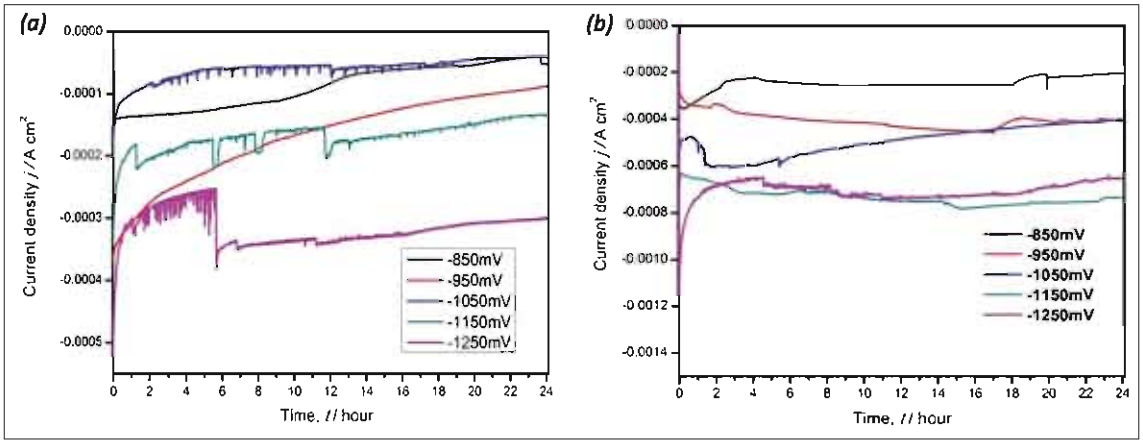
Division involved : Corrosion and Materials Protection
Nodal Officer : Dr. Rakesh Barik
Sponsor : Department of Science and Technology
Duration : August 2012 – August 2015
Budget : Rs 23.6 lakh

Objectives

- To investigate cathodic protection of mild steel in soil; and
- To investigate the interaction of microbes such as sulfate reducing bacteria (SRB) on metal surface.

Highlights

- The effect of SRB on cathodic protection of the mild steel in soil was studied. The results showed that the corrosion protection requires more current density in the presence of SRB in soil than in the absence of SRB.



Typical current density measured for the different applied cathodic protection potentiol in soil environment in (a) absence and (b) presence of SRB on mild steel.

GAP-06/13

Molecular recognition of bio-molecules: Enhancement of sensitivity and selectivity using functional siloxane membranes

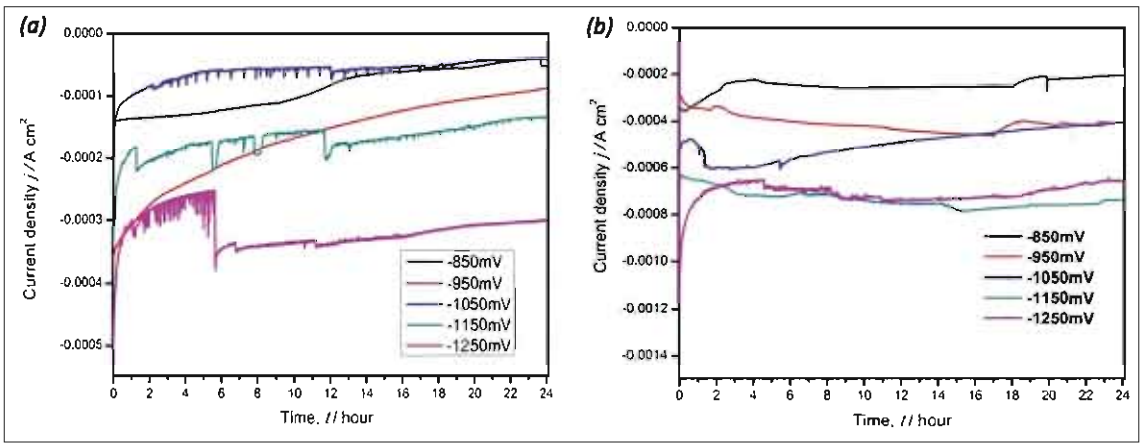
Division involved : Electrodics and Electrocatalysis
Nodal Officer : Dr. James Joseph
Co-Nodal Officer : Dr. C. Sivakumar
Sponsor : Department of Science and Technology
Budget : Rs 18.66 lakh

Objectives

- To develop methods for the synthesis of nano-noble metal sols (Au, Ag, Pd and Pt) and semiconductor QDs like CdSe-ZnS entrapped in functional siloxane networks;
- To optimize film-forming strategies for the preparation of monolayers (using thiolatedsilanes) and multilayer networks of siloxane polymers on solid electrodes and to characterize them;
- To standardize sensing schemes such as immobilization of biomolecules like enzymes, Glucose oxidase, Urease and Creatinine deiminase, chemically derivatizing with cyclodextrins, selective ionophores, etc.; and
- To work out strategies for enhancing selectivity and sensitivity of the functional siloxane membranes using specific interactions between the analyte and membrane.

Highlights

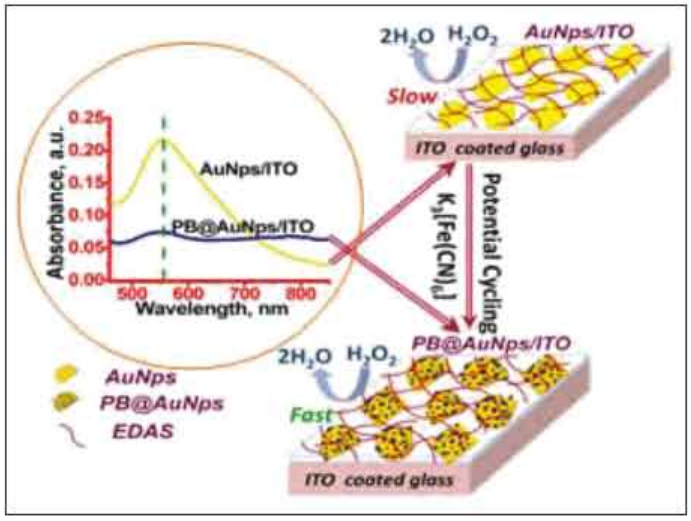
- We demonstrated selective patterning of electrodes coated with N-[3-(trimethoxysilyl) propyl]ethylenediamine-stabilised gold nanoparticle (Sil-AuNps) films with prussian blue (PB) by continuous electrochemical cycling of Sil-AuNp film-modified indium tin oxide (ITO) electrode in $K_3[Fe(CN_6)]$ solution. The PB formed on gold nanoparticles (PB@Sil-AuNps) exhibited electrochemical response similar to the PB formed on bare ITO. However, the high spin iron redox state in PB formed on Sil-AuNps showed almost zero peak-to-peak separation (ΔEp) in contrast to a finite ΔEp for PB formed on bare ITO. In addition, the selectively patterned PB on Sil-AuNp-modified ITO showed characteristic voltammetric responses of both PB and gold in 0.1M KNO_3 and 0.SM H_2SO_4. In order to see the coverage of PB over gold nanoparticles, ITO electrode

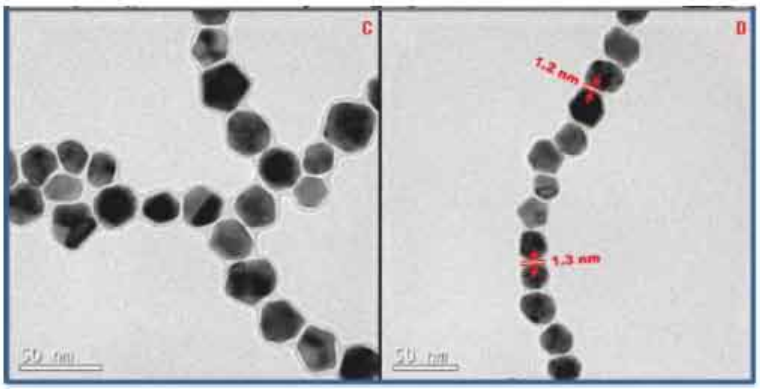


Typical current density measured for the different applied cathodic protection potential in soil environment in (a) absence and (b) presence of SRB on mild steel.

was characterised by SEM EDX. Selective patterning of redox mediator on noble metal nanoparticles results in less film resistivity, which favours high electrocatalytic activity towards hydrogen peroxide electro-reduction. The sensitivity of this modified electrode towards H_2O_2 was 3.4 nA/nM.

- Organized assemblies of polysiloxanes having specific functional groups were used for the synthesis of 1-D nanochains of Au separated by 1–2 nm gap silica peapod. The ability of protonated amines of polysilsequioxanes having hexagonal rod-like structure formed from N-[3-(trimethoxysilyl)propyl]-ethylene diamine can serve as binding sites for $AuCl_4^-$ anions. The nano gap chains of Au formed by the auto reduction of self-assembled $AuCl_4^-$ were characterized by TEM. A mechanism of formation of Au nanochains separated by siloxane layer was proposed. Application of Au nanochains as SERS substrates was demonstrated.





GAP-09/13

Electrochemical detection of endotoxin using complementary pattern recognition receptors

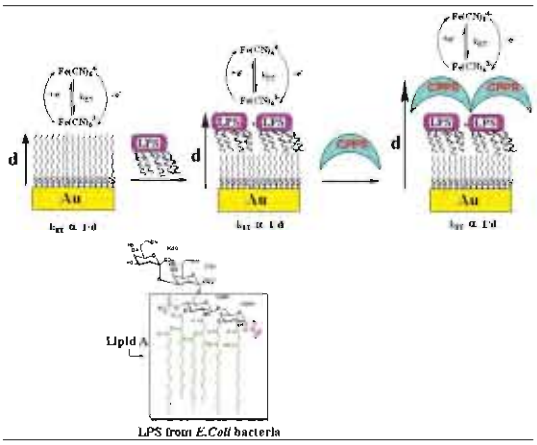
Division involved	: Electrodics and Electrocatalysis – Biosensors
Nodal Officer	: Dr. V. Ganesh
Co-Nodal Officers	: Dr. Sheela Berchmans and Dr. A. Palaniappan
Sponsor	: Department of Science and Technology
Budget	: Rs 28.124 lakh

Objectives

- To immobilize endotoxins from different bacteria on monolayer modified surfaces and to characterize them;
- To bind various structural components present in LPS to a suitable receptor using complementary pattern recognition;
- To probe binding events with a charged redox probe; and
- To develop a simple methodology for LPS sensing and detoxification.

Highlights

- Self-assembled monolayers of various functional molecules on electrode surfaces were prepared for use as a platform for LPS detection. Moreover, size-controlled, emission colour-tunable graphene quantum dots for LPS sensing using fluorescence method were prepared and characterized. Endotoxin, commonly known as LPS has different structural components. Our aim is to detect LPS using a new concept of complementary pattern recognition receptors. Suitable binding elements to the various receptors present in LPS will be identified and the binding events probed using electrochemical techniques such as CV and EIS. In addition, fluorescence method will also be explored for LPS sensing. Finally, a simple methodology will be developed for sensing endotoxins (LPS), which may find potential applications in clinics and water purification systems.



Schematic representatian of the proposed methodology for LPS sensing. The chemicol structure of LPS from E. Coli bacteria is also given to illustrate the different structurol components in LPS.

GAP-10/13

Removal of herbicides from water by advanced electro-oxidation processes

Division involved	: Electro-Inorganic Chemicals
Nodal Officer	: Dr. S. Vasudevan
Co-Nodal Officers	: Dr. D. Jonas Davidson and Dr. G. Sozhan
Sponsor	: Department of Science and Technology
Duration	: July 2013 – June 2016
Budget	: Rs 19.412 lakh

Objectives

- To remove the most commonly used chlorophenoxyacid herbicides, including 2-(2-methyl-4-chlorophenoxy) propionic acid (MCPP), 4-chloro-2-methylphenoxyacetic acid (MCPA), 2,4-dichlorophenoxyacetic acid (2,4-D), 2-(2,4-dichlorophenoxy) propionic acid (2,4-DP), and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) from drinking water by an advanced electro-oxidation process.

Highlights

- Direct oxidation of herbicides: Direct oxidation studies were carried out using BDD, Ti/PbO_2, Pb/PbO_2, Ti/Pt, Ti/IrO_2, Ti/SnO_2 as anode materials. Graphite, Pd-Ag/Ti, N-doped carbon nanotube were used as cathode. A maximum removal efficiency of 63% was achieved with BDD and Ti/Pt as anodes and graphite as cathode. The electrolyte had a 2,4-D concentration of 175 ppm with 0.05M Na_2SO_4 as supporting electrolyte, *p*H: 3.0, temperature: 30°C. A total charge of 12.27 Ah was passed.
- Advanced electrooxidation process: Oxidation/mineralization studies of herbicides viz. 2,4-D and 2,4,5-T were carried out. The mineralization efficiency was higher in the advanced electro-oxidation process than that in the direct anodic oxidation process, and was related to a higher amount of continuous $OH^{\cdot}$ radicals in the former process. The complete mineralization of 175 mg/l (0.8 mM) of 2,4-D and 2,4,5-T occurred at 12.72 Ah with BDD as anode and S-doped carbon as cathode.
- Electrocoagulation process: Removal of 2,4-D and 2,4,5-T was carried out. An optimized removal efficiency of 91% was achieved with iron as anode at a current density of 0.10 A/dm^2 and a *p*H of 7.0 for 2,4-D. In the case of 2,4,5-T, a maximum removal efficiency of 86% was achieved with aluminum alloy as anode at a current density of 0.10 A/dm^2 and a *p*H of 7.0.

GAP-11/13

Development of nano-topography of favorable composition on Ti and Ti alloys by chemical solution treatments for bone and dental application

Division involved	: Chlor-Alkali
Nodal Officer	: Dr. Deepak Kumar Pattanayak
Sponsor	: Department of Science and Technology
Duration	: July 2013 – July 2016
Budget	: Rs 25.96 lakh

Objectives

- To understand the relationship between metallic material (Ti and Ti alloys) and its surface response to the apatite (calcium phosphate) formation in simulated body fluid solution (SBF); and
- To propose surface modification with Ca^{+2}, Sr^{+2}, Si^{+4}, Ag^{+} ions that can induce fast bone formation as well as antibacterial effect when implanted in the body.

Highlights

- Highly porous network structure incorporated with silver nano-particle of different silver concentrations on Ti metal by chemical treatment showed good bioactivity, antibacterial activity and cell compatibility.

G.S. Tendolkar best paper prize was won by Ms. Archana Rajendran for the paper *Silver nanoparticle incorporated porous nano-structured titania layer on Ti metal: A candidate for orthopedic implant* at the International Conference on Powder Metallurgy & Particulate Materials, Chennai, January 23–25, 2014.

Ms. Archana Rajendran won the best poster paper award for the paper *Development of bioactive titanium metal with antibacterial property by simple chemical treatment approach* at the National Seminar on Challenges in Biomaterials and Research, VIT university, Vellore, December 23&24, 2013

GAP-12/13

Generation and electrochemical reactivity of metal atomic clusters

Division involved	: Electrodics and Electrocatalysis Nanoscale Electrocatalysis
Nodal Officer	: Dr. K.L.N. Phani
Co-Nodal Officer	: Dr. S. Senthil Kumar
Sponsor	: Department of Science and Technology
Duration	: August 2011 – July 2014
Budget	: Rs 49 lakh

Objectives

- Chemical/electrochemical synthesis of dispersions of metal atomic clusters and their immobilization on electrode surfaces;
- Characterization of metal atomic clusters using spectroscopy, bulk-continuum / molecule-like voltammetry, XPS, MS, STM and I-V spectroscopy;
- Catalytic electro-sorptive properties of Au_n clusters, with $n < 25$ atoms for electrocatalytic reactions: oxygen reduction and hydrogen evolution, CO oxidation, and metal underpotential deposition; and
- Transition of atomic clusters of gold to nanoparticles using electrochemical STM and I-V spectroscopy on restricted regions of the cluster-/nanoparticle-modified electrodes.

Highlights

- While the present research focuses on the experimental approaches to address the issues of electrocatalytic activity versus cluster size, *exploration of means to discover how the nascent surface plasmon resonance looks like?* is an important step in this project. In this work, we report findings on a new room-temperature method that bridges the features of thermal citrate-reduction and the polyol process. This work demonstrates how the fundamental paradigms of simple multiple bond chemistry can be of use in monitoring *particle formation from metal clusters to nanoparticles*. Some of the Au-clusters are inferred to be hydride-type and theoretical calculations based on density functional theory are being implemented.
- Electrochemical dealloying under potentiodynamic conditions (potential cycling) induces not only changes from rather spherical high-index faceted to more cuboctahedral low-index faceted core–shell structures for particles in a size range of 10–20 nm but also percolation for some particles larger than 20 nm. In contrast, during dealloying under potentiostatic conditions (potential hold) the semispherical shape of small particles is completely retained and extensive porosity is formed on all particles larger than 20 nm. The difference in dealloying protocols and their effect on the structure of the catalysts as well as their activities, considering the promising porosity formation, are discussed and indicate future directions for a rational design of active and stable oxygen reduction reaction catalysts.
- We have successfully fabricated nanoelectrode tips of radius < 10 nm for (a) immobilizing single nanoparticles; (b) carrying out high-resolution scanning electrochemical microscopy; and (c) mapping local *p*H changes that occur during the surface-confined electrochemical reactions.

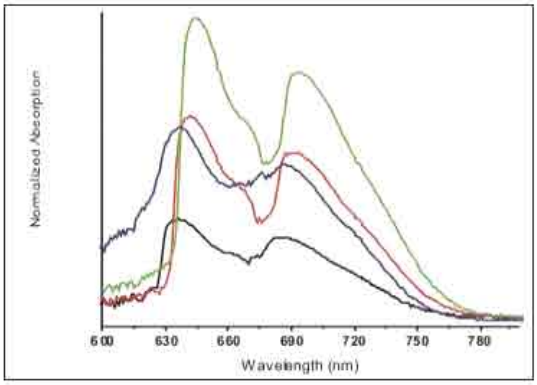
GAP-15/13

Synthesis, photoluminescence, redox, and electrogenerated chemiluminescence of novel squaraine dyes

Division involved	: Functional Materials
Nodal Officer	: Dr. Palani Natarajan
Sponsor	: Department of Science and Technology
Duration	: April 2012 – March 2017
Budget	: Rs 25 lakh

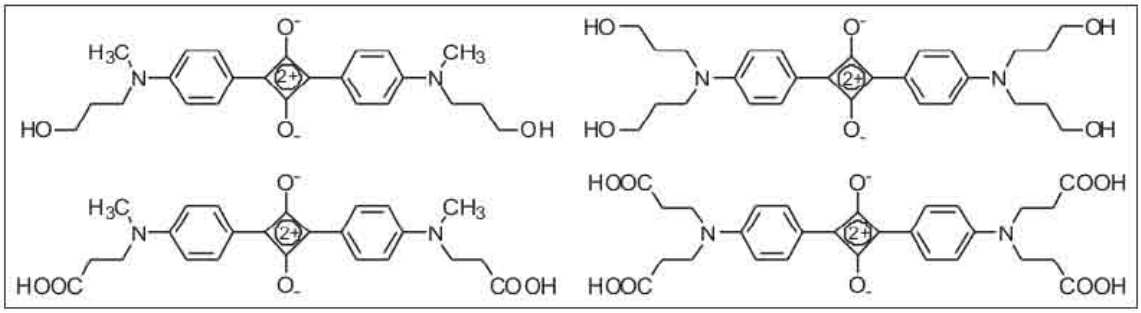
Highlights

- Squaraine dyes are believed to be an important group of luminescence materials in the area of light emitting devices. In this work, we tuned the side chains in a series of squaraine dyes (SQDs), to investigate the effect of structural variations on the redox as well as luminescence character. All the compounds exhibited two reversible oxidation steps irrespective of the number and nature of the substituent. Nevertheless, the emission wavelength and quantum yield of the dyes proved to depend largely on the number of substituents. Di-substituted compounds showed a more intense photo- and electrogenerated luminescence than the tetra-substituted analogues. The di-substituted squaranes may find applications including in luminescence sensors and imaging.



Uv–vis absorption and photoluminescence spectra of SQDS in dicholoromethane.

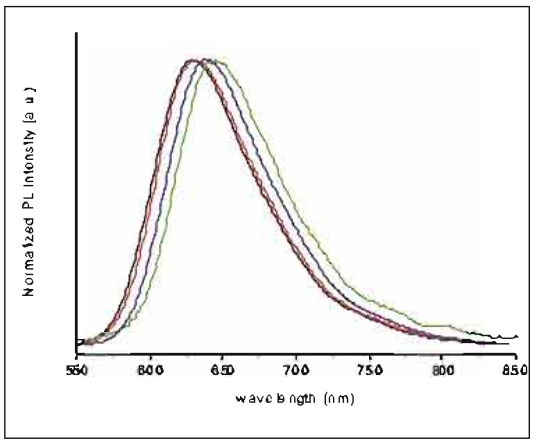
- SQDS readily dissolve in organic solvents (chloroform, dichloromethane, tetrahydrofuran, methanol, dimethylformamide) to give blue solutions with sharp absorption maxima as well as intense



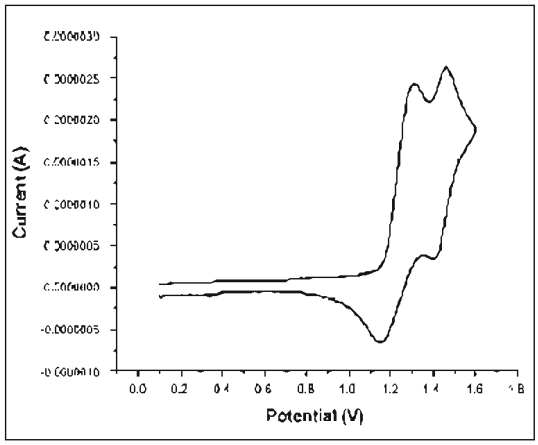
Molecular structures of the squaraine dyes

fluorescence. In dicholoromethane, for example, the absorption maximum lies between 630 and 640 nm with an extinction coefficient of $3.1–4.2x10^5$/M/cm; the fluorescence maximum lies between 653 and 670 nm with quantum yield of > 0.7.

- The CV of SQDS in dichloromethane with tetrabutylammonium-hexafluorophosphate ($TBAPF_6$) as the supporting electrolyte at a scan rate of 100 mV/s showed two redox waves between +1.1 and +1.5 V. The first oxidation wave is assigned to the oxidation of one aniline-moiety, and the other to the other aniline substituent. Electrochemiluminescence (ECL) of SQDS was recorded in an oxidative–reduction protocol employing tri-n-propylamine as a co-reactant and $TBAPF_6$ as a supporting electrolyte in dichloromethane by sweeping the potential reversibly from +1.0 to +1.6 V. Satisfactory ECL spectra with a defined emission maximum were noticed starting at concentrations above $4x10^{-4}$ M of SQDS. Preliminary results suggest that SQDS will find more applications because of their good light and redox stabilities as well as high quantum yield.



Uv–vis absorption and photoluminescence spectra of SQDS in dicholoromethane.



Cyclic voltammogram of SQDS in dichloromethane.

GAP-18/13

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

Division involved	: Electrodics and Electrocatalysis
Nodal Officer	: Dr. S. Senthil Kumar
Sponsor	: Department of Science and Technology
Duration	: July 2013 – July 2017
Budget	: Rs 44.476 lakh

Objectives

- To develop a novel synthetic protocol for preparing noble metal clusters by chemical and electrochemical methods;
- To elucidate the possible mechanism of electron transfer annihilation of electro-generated anion and cation radicals from metal clusters via inter and intra-band transition 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; and
- To design and fabricate a simple metal cluster-based ECL electrode assembly to improve the ECL intensity and thereby enhance selectivity and sensitivity of analyte molecule to an extent approaching zepto-molar levels and possibly single-molecule detection.

Highlights

- Silver clusters were synthesized by a facile and fast electrochemical route without using any stabilizers or surfactants. MALDI-TOF and TEM characterizations confirmed the formation of Ag_9 clusters and highly monodispersed spherical shape and of size below 5 nm. Electrochemical studies revealed that the Ag_9 clusters their quantized double layer charging behaviors and showed red emission of florescence at 560 nm. Interestingly, the Ag_9 cluster exhibited a good cathodic ECL signal when persulfate was used as a co-reactant.

Scanning Electron Microscope (SEM) S-3000H (Hitachi)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NMR spectrometer Advance 400 MHz (Bruker)

CLP 10/11

Energy conversion reactions: fine-tuning of electrocatalytic activity through surface manipulation guided by in situ spectroscopic and microscopic studies

Division involved	: Electrodics and Electrocatalysis – Nanoscale Electrocatalysis (plus Monash University)
Nodal Officer	: Dr. K.L.N. Phani
Co-Nodal Officer	: Dr. S. Senthil Kumar
Sponsor	: Department of Science and Technology
Duration	: October 2011 – October 2014
Budget	: Rs 20 lakh

Objectives

- Uncovering surface events during electrocatalysis; and
- Atomic-level manipulation of surfaces for electrocatalysis of energy conversion reactions.

Highlights

- Hydroxyl radicals from the Fenton reagent remove meta-stable surface gold atoms (low-coordinated high-energy surface atoms) on Au surface, thus precluding the formation of stable oxides. The resultant smooth surface, on hydroxyl-radical activation electrocatalyzes oxygen evolution reaction in 0.1 M NaOH at overpotentials lowered by 190 mV at 10 mA/cm^2. Facile electrochemical co-deposition method for the fabrication of graphene/cobalt nanocomposite modified electrodes for highly efficient water oxidation in alkaline media. This nanocomposite film exhibits excellent activity and stability for water oxidation to form oxygen in 1 M NaOH aqueous electrolyte media. A turn-over frequency of 33.7 s^{-1} at η = 0.59 V with a Faradaic efficiency of 97.7% was measured using RRDE voltammetry. Controlled potential electrolysis data suggest that the graphene-supported catalyst exhibits excellent stability under the harsh catalytic turnover conditions. Large amplitude Fourier transformed ac voltammetry explains the co-redox process involved in the electrocatalysis of water oxidation.

CLP 16/11

Generation, storage and distribution of solar hydrogen

Division involved	: Electro-Inorganic Chemicals and Electropyrometallurgy
Nodal Officer	: Dr. S. Ravichandran
Co-Nodal Officer	: Dr. G. Sozhan, Dr. S. Vasudevan and Dr. Jonas Davidson
Sponsor	: Department of Science and Technology
Duration	: March 2012 - February 2014
Budget	: Rs 85 lakh

Objectives

- Design, synthesis and characterization of non-noble metal catalysts for water electrolysis.

Highlights

- Generally, precious metal catalysts used for water oxidation limit commercial viability of the process. Hence, the present work is aimed at preparing low-cost water oxidation catalysts. Towards this objective, we first prepared nickel electrode by electrodeposition. Calcium ferrite and manganese ferrite were synthesized by mechano-chemical method. A commercially available hydroxyl conducting membrane FAA-3 was used to make a membrane electrode assembly for water electrolysis.

CLP 13/12

Development of environmental friendly coating to replace hexavalent chrome plating with trivalent chrome plating multilayer plating baths

Division involved	: Electrochemical Metal Finishing Technology
Nodal Officer	: Dr. S. Mohan
Members	: Dr. Shailendra Kumar Jha, Dr. Subhendu K. Panda and Dr. Naveen Chandrasekar
Sponsor	: Boeing, USA
Duration	: Upto February 2017
Budget	: Rs 1.27 crore

Objectives

- To develop a tri-chrome plating set up;
- To develop a trivalent chromium layer to a thickness of 75 micron with boric acid;
- To develop a trivalent chromium without boric acid;
- To develop an initial Fe-Cr multilayer;
- To test the chromium-deposited plates;
- Solution analysis;
- Internal surfaces;
- Wear test;
- Fatigue test.

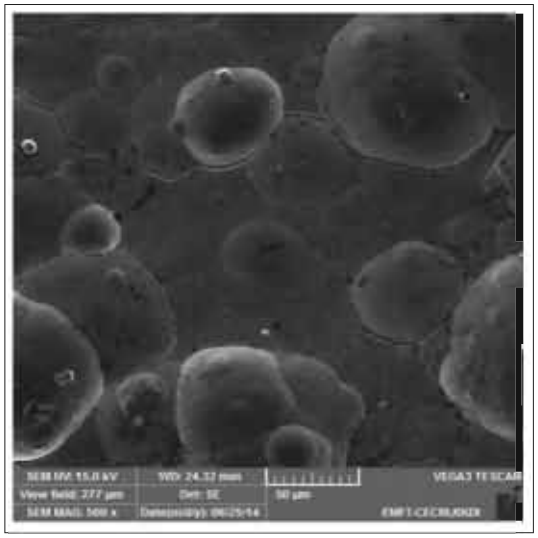
Highlights

- The 4130 steel was electro-cleaned anodically in a solution of 70 g/l Na_2CO_3 and 50 g/l of NaOH. A current of 0.50 mA/cm^2 was passed for 2 min and it was rinsed with water. After alkali cleaning the 4130 steel surface was immersed in a solution of 25% H_2SO_4, 4% HF and 71% DI water. A current of 0.465A/cm^2 was passed for 1 min. After one-minute anodic etching, the plate was rinsed with water and plated immediately with chromium. We have optimized the trivalent chromium electrolyte bath for chromium deposition and achieved a thickness of 75 microns on a mild steel surface of 4 cm^2 and also a thickness of 32 microns on 4130 steel over 25cm^2 surface area.

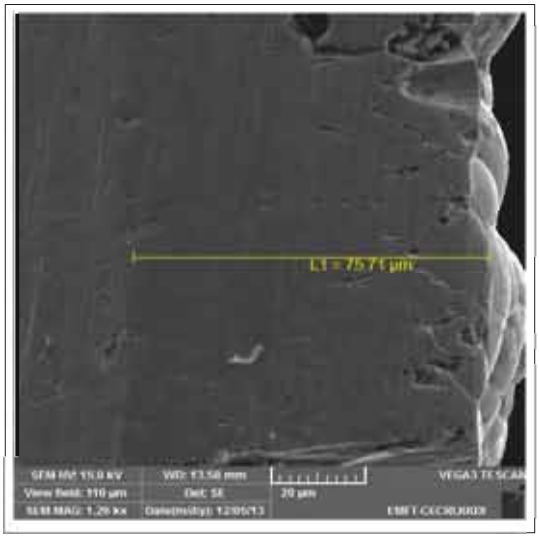
Grit-blasted 4130 sample.

Tri-chrome plating set up.

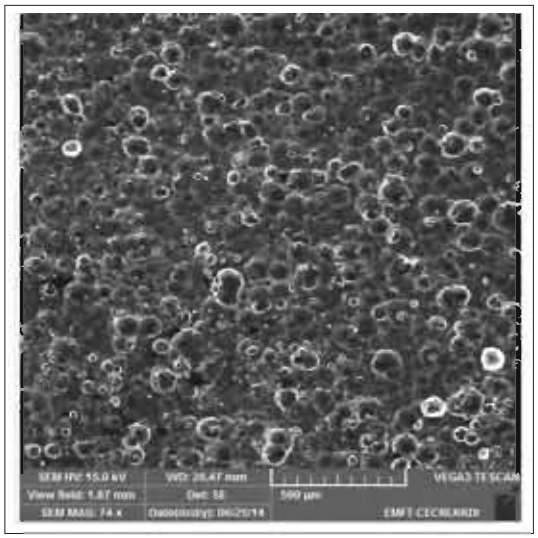
Electroplating cell



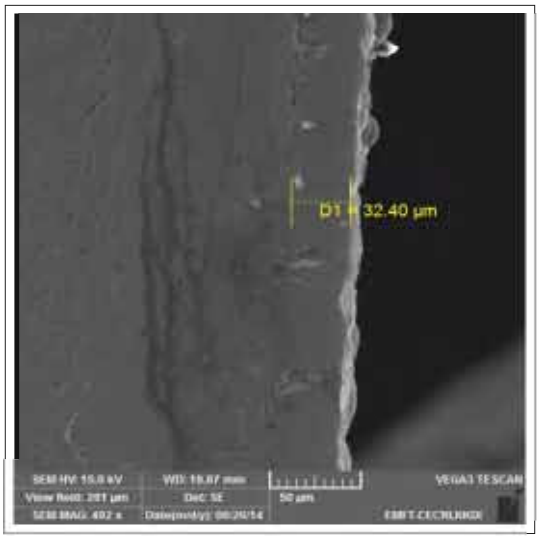
Surfoce morphology of deposited chromium on mild steel.



Cross sectionol image of deposited chromium on mild steel.



Surface morphology of deposited chromium on 4130 steel.



Cross sectional image of deposited chromium on 4130 steel.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Laser Raman microscope (Renishow Invia)

SSP-05/11

Development of electroless nickel wear and corrosion-resistant coating on titanium alloy Ti-10V-2Fe-3Al components

Division involved	: Electroplating and Metal Finishing Technology
Nodal Officer	: Dr. K.N. Srinivasan
Members	: Dr. M. Selvam and Shri. PR. Thangavelu
Sponsor	: Aeronautical Development Agency, Bangalore
Duration	: July 2011 – December 2014
Budget	: Rs 16.99 lakh

Objectives

- To develop a suitable electroless nickel bath for plating on Ti-10V -2Fe-3Al grade titanium alloy components to meet the requirements of ADA, Bangalore as per MIL specifications;
- To optimize suitable pre-treatment processes for adherent deposit of electroless nickel on titanium;
- To develop a suitable electroless nickel bath with medium phosphorous content (8–10%) in the deposit;
- To deposit electroless nickel on 25 titanium coupons (75 mm x 25 mm) after standardizing suitable pre-treatment processes for the evaluation of various properties such as hardness, adhesion, hydrogen embrittlement behaviour and fatigue strength. Effect of heat treatment in the presence and absence of oxygen on the above properties also to be studied;
- To carryout type test and get it approved as per the relevant type test schedule;
- To carryout electroless nickel plating on six slat track components; and
- To suggest a suitable plating sequence for worn-out areas in the components.

Highlights

- Suitable pre-plating surface preparation methodology were developed for Ti alloy, which otherwise is difficult to plate due to titanium oxide surface layer. The surface preparation involved zincating and nickel strike. Formulation of plating bath composition and plating parameters with respect to bath pH and temperature were established. Plating Ti alloy specimens was completed followed by post-plating heat treatment. Post-plating heat treatment involved baking at 200°C for 20 h, followed by heating at 400°C for 1 h. Testing of the plated specimens was completed with respect to plating thickness, adhesion, salt spray corrosion and wear resistance. The results were in accordance with the test schedule.

SSP-09/11

Development of wear and corrosion resistant internal plating scheme for actuator components of Tejas

Division involved	: Electroplating and Metal Finishing Technology
Nodal Officer	: Dr. K.N. Srinivasan
Members	: Dr. M. Selvam and Shri. P.R. Thangavelu
Sponsor	: Aeronautical Development Agency, Bangalore
Duration	: October 2011 – March 2014
Budget	: Rs 17.51 lakh

Objectives

- To develop a suitable electroless nickel bath for plating on 15-5-PH stainless steel to meet the test schedule requirements of ADA, Bangalore as per specifications;
- To optimize suitable pre-treatment processes for adherent deposit of electroless nickel on 15-5-PH stainless steel;
- To develop a suitable electroless nickel bath with medium phosphorous content (8–10%) in the deposit to achieve better corrosion and wear resistance;
- To deposit electroless nickel on 25 pieces of 15-5-PH stainless steel coupons of size 75 x 25 mm and inner portions of steel pipes after standardizing suitable pretreatment processes for the evaluation of various properties such as hardness, adhesion, and hydrogen embrittlement behaviour and fatigue strength. Effect of heat treatment on the above properties will also be studied;
- To carryout type test and get it approved as per the relevant type test schedule;
- To carryout electroless nickel plating on the steel pipes of similar diameter and wall thickness of the following components to a final plating thickness of 40 µm with a surface finish of 0.4 µm;
- To carryout electroless nickel plating on 15-5-PH stainless steel components to a final thickness of 40 µm with a surface finish of 0.4 µm; and
- To assist ADA in establishing the process in identified work center under separate terms and conditions.

As-received forward cylinder and rod impulse.

Electroless nickel-plated forward cylinder and rod impulse

Highlights

- 5tandardized the pre-treatment steps for getting adherent electroless nickel on MDN 15-5PH steel without an intermediate nickel strike. Formulation of plating bath composition and plating parameters with respect to bath *p*H and temperature was established. Prepared samples for tensile, hardness, wear, adhesion, hardness and also salt spray testing. Following tests were carried out on the plated coupons. (a) adhesion testing by bend test, quenching test, etc.; (b) measured the hardness of the coating with and without heat treatment at 400°C; (c) wear resistance of the coating was calculated using Taber abraser; (d) samples after electroless nickel plating to a thickness to 45 microns were sent to ADA for tensile testing; (e) salt spray testing on the samples was conducted as per ASTM - B117. It was found that all the coupons withstood the minimum requirement of 144 h without indication of any corrosion spot.
- Provisional clearance certificate was obtained from DRDO for military airworthiness for indigenously developed wear and corrosion resistant internal plating scheme for actuator components of Tejas aircraft. Received forward cylinder and rod impulse made of 15-5-PH stainless steel from ADA. Pre-treated the components and plated with 45 microns of electroless nickel, heat treated, polished and chromated and sent to ADA for evaluation. It passed the impulse pressure tests or more than 2 lakh cycles. Electroless nickel plated, heat treated, polished and chromated forward cylinder and rod impulse 5tandardized the pre-treatment steps for getting adherent electroless nickel on MDN 15-5PH steel without intermediate nickel strike. Formulation of plating bath composition and plating parameters with respect to bath pH and temperature was established. Prepared samples for tensile, hardness, wear, adhesion, hardness and also salt spray testing .Following tests were carried out on the plated coupons: (a) adhesion testing by bend test, quenching test, etc.; (b) measured the hardness of the coating with and without heat treatment at 400oC; (c) wear resistance of the coating was calculated using Taber abraser; (d) samples after electroless nickel plating to a thickness to 45 microns were sent to ADA for tensile testing; (e) salt spray testing on the samples was conducted as per ASTM - B117. It was found that all the coupons withstood the minimum requirement of 144 h without

Electroless nickel-plated, heat-treated, polished ond chromated forward cylinder ond rod impulse

SSP-10/12

Studying the causes of corrosion and suggesting the remedial measures to control internal corrosion in petroleum product pipeline between Mundra-Delhi pipeline

Division involved	: Corrosion and Material Protection
Nodal Officer	: Dr. S. Maruthamuthu
Members	: Dr. N. Palaniswamy, Dr. P. Subramanian, Dr. S. Muralidharan, Dr. Rakesh Barik, Er. K. Arumugaswamy and Er. V. Raju
Sponsor	: Hindustan Petroleum Corporation Limited
Duration	: November 2012 – April 2014
Budget	: Rs 13.11 lakh

Objectives

- To identify the causes of internal corrosion in petroleum pipeline about 1054 km; and
- To suggest remedial measures to mitigate the problem.

Highlights

- An attempt was made to characterize the muck product samples collected from the HPCL stations. The *p*H value was in the range between 3.12 and 7.93. The concentration of chloride was in the range between 35 and 260 mg/kg. The sulphate concentration was almost nil. The accumulation of trace metals was also noticed in the muck products. Heterotrophic bacteria, iron bacteria, acid producing bacteria, manganese oxidizing bacteria and sulphate reducing bacteria were noticed in the pipeline. In the present study, the evaluation of inhibitors was done by employing stagnation method and rotating cage method (ASTM G184). A suitable inhibitor was recommended.

SSP-04/13

Electrochemical characterization of catalyst for water splitting by PEM electrolyser

Division involved	: Electro-inorganic Chemicals
Nodal Officer	: Dr. G. Sozhan
Members	: Dr. S. Vasudevan, Dr. Jonas Davidson, Dr. S. Ravichandran, Dr. S. Vengatesan and Dr. S. Mohan
Sponsor	: NATCO Pharma Limited, Hyderabad
Duration	: June 2013 – November 2013
Budget	: Rs 4 lakh

Objectives

- To characterize a catalyst supplied by the company In a proton exchange membrane electrolyzer.

Highlights

- Three PEM single-cell electrolyzers with 4 cm^2 working area were designed. The components of the cell (titanium monopolar plates, stainless steel end plates with provisions for fasteners and water inlet, and oxygen and hydrogen outlets) were fabricated. Membrane electrode assemblies were prepared using the supplied catalyst and Nafion membrane and with various conditions and parameters. Electrochemical characterization of the MEA was carried.

SSP-05/13

Selection of suitable corrosion inhibitors for crude oil pipelines

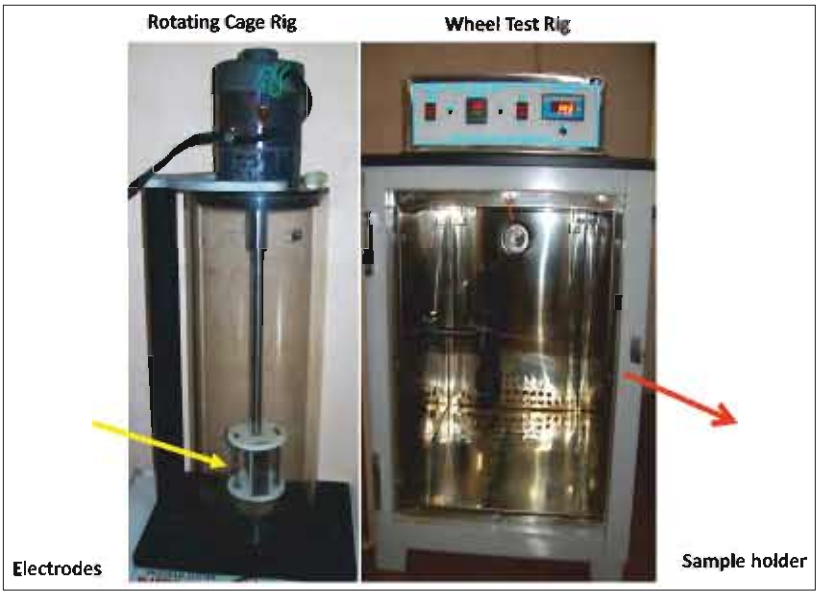
Division involved : Corrosion and Materials Protection
Nodal Officer : Dr. S. Muralidharan
Members : Shri. S. Ramu, Dr. D. Jayaperumal, Dr. S. Maruthamuthu, Dr. Rakesh Barik, Shri. R. Jeyaram, Er. K. Arumugasamy and Er. V. Raju
Sponsor : Indian Oil Corporation Limited
Duration : June 2013 – May 2014
Budget : Rs 23.60 lakh

Objectives

- To control the internal corrosion of crude oil transport pipeline by inhibitor;
- To investigate the performance of various inhibitors and suggest their inhibitory mechanisms;
- To investigate the microbial corrosion coupled with use of inhibitors; and
- To recommend the dosage rates to achieve required inhibition efficiency based on laboratory testing.

Highlights

- Five oil-soluble inhibitors were tested in three different crude oils by two flow rigs: rotating cage electrode and wheel test. Crude oils were varied based on sulfur and water content. The pipeline steel used was API 5L-X65, recommended inhibitor concentration was 35 ppm and chloride concentration was 35,000 ppm for the 96 h test duration. Measurements were made at a number of rotation rates to evaluate the inhibitor performance under increasingly severe hydrodynamic conditions. Results showed 50–80% efficiency of inhibitors and the best can be recommended to IOCL for implementation in their crude oil carrying pipeline to prevent the internal corrosion.



SSP-07/13

Electroless nickel plating of LCA slat tracks

Division involved	: Electroplating and Metal Finishing Technology
Nodal Officer	: Dr. K. N.Srinivasan
Members	: Dr. M. Selvam, Smt. Shanmugasigamani and Shri P.R. Thangavelu
Sponsor	: HAL, Bangalore
Duration	: June 2013 – July 2014
Budget	: Rs 5.18 lakh

Objectives

- To prepare electroless nickel plating bath and to test various properties of the coating.

Highlights

- 100 litres of electroless bath prepared. Metal contamination in the nickel sulfate was removed by dummying. Actual components of slat track components were plated in four batches to a thickness of 35–45 microns. Heat treatment of the slat track components were relived of hydrogen at 200°C for 20 h and then heat treated at 300°C for 10 h. Polishing of slat track components were carried out to Ra values of 0.5 to 3 microns. Chromating of the polished slat track was carried out.

Electroless nickel set up

Heat-treated slat track components

Heat-treated, polished and chromated slat track components

SSP-13/13

Life studies on composite canister assembly

Division involved	: Corrosion and Materials Protection
Nodal Officer	: Dr. S. Syed Azim
Members	: Dr. S. Nathria Begum
Sponsor	: Advance System Laboratory, DRDL, Hyderabad
Duration	: June 2013 – December 2015
Budget	: Rs 12.99 lakh

Objectives

- To carry out life studies on canister assembly by carrying out integrated qualification test methods as per GOST/ASTM Standards: (a) flame retardant test. Gost 12.044-89; (b) resistance to corrosive agents ASTM B117; (c) accelerated climatic/weathering test ASTMG154; (d) resistance to microbial growth per GOST 9.048-89 as per GOST 9.049-91 or ASTM D3274; (e) rodent test; (f) all- weather test (40°C to +55°C, RH 98% @ 40°C – 30 cycles); (g) exposure to marine environment for 120 days; (h) hygrothermal test (water uptake studies); (i) galvanic compatibility —MDN138 (PH steel) and Titan 31A; MDN 138 and S2 laminate; Titan 31A and S2 laminate; EN 24 steel & 15CDV6 steel; EN 24 steel and S2 laminate; and 15CDV6 steel and S2 laminate.

Highlights

- RR, RI, IIT and IIF samples passed 2,000 h of continuous salt spray test as per ASTM B117- indicating that all these composite materials when exposed to marine environment will have a life of 18–20 years. The composite samples were ranked RR > RI > IIF > IIT with respect to their hygrothermal behavior. Hygrothermal tests for separate layers of canister samples showed the following behavior: RR – middle 1 > top > middle 2 > bottom; RI – middle 1 > top > bottom > middle 2; IIT – middle 1 > bottom > top > middle 2; IIF – top > middle > bottom. All the four canister samples passed the all-weather test indicating

Canister bulk head exposed to marine environment at Mandapam yard to compare the life from actual field conditions with laboratory-simulated conditions.

Galvanic corrosion studies were carried out for the first time for canister bulk heads

there was good Inter bonding between different layers. Potential–time measurements help in understanding the corrosion tendency of metals. The potentials were measured in synthetic sea water and the metals were arranged as: titanium BT6C

(–0.129 mV vs. SCE); 03X11H10M2T-ВД; MDN13-8; 15CD V6 steel; EN24 steel (–0.754 mV vs. SCE). But for the RR composite, the other three canister samples passed the resistance to fungal growth test as per GOST 9.048-89 as per GOST 9.049-91. Corrosion rates were calculated (mmpy) for the following galvanic couples by the galvanic compatibility test. The results are in the following order: 15CDV6-S2 laminate (1.18 x 10^{-2} mmpy); EN24-15CDV6 (8.85 x 10^{-2} mmpy); EN24-S2 laminate (1.35 x 10^{-2} mmpy); MDN-S2 laminate (1.68 x 10^{-2} mmpy). All the four canister samples passed 500 h of the accelerated weather test ASTM G154, indicating that the composite canisters could withstand 5–6 years of exposure to alternate UV radiation and condensation in actual environments. All the samples passed the flame retardant test ASTM standard suggesting that they had good flame retardant properties.

- CECRI scientists established methods to evaluate composite canister assembly as per GOST and ASTM standards.

SSP-17/13

Indigenous development of electrodeposited blanks for coin minting

Division involved	: Industrial Metal Finishing
Nodal Officer	: Dr. P. Veeramani
Members	: Dr. N.V. Shanmugam and Dr. SM. Silaimani
Sponsor	: Indian Government Mint, Mumbai
Duration	: October 2013 – June 2014
Budget	: Rs 10.25 lakh

Objectives

- Feasibility study on electroplated version on steel and aluminium blanks for coin production.

Highlights

- Various metallic coatings were deposited on steel substrate and corrosion behavior was studied.

SSP-19/13

Development of electrolytic processes for the removal carbonate, oxalate, acetate, formate and dark black red organic compound from the impure tetramethyl ammonium hydroxide (TMAH) and to produce pure TMAH from the purified solution

Division involved : Chlor-Alkali
Nodal Officer : Dr. K. Subramanian
Members : Dr. G. Rajagopal
Sponsor : NOCIL Limited, Navi Mumbai
Duration : December 2013 – May 2014
Budget : Rs 9 lakh

Objectives

- Studies and development of technological process for purification of recycled base of impure TMAH and convert into pure TMA chloride.

Highlights

- 4-Amino diphenylamine (4-ADPA) is used in the rubber industries especially in the manufacture of tyres for automobiles. It is manufactured using TMAH (base) as a catalyst. After several manufacturing cycles the recycled base solution is highly contaminated with aromatic base compounds and leading to a tar like dark coloured viscous solution. The above solution contains about 300 g/l of TMAH. Moreover, the above recycled base cannot be let into the environment and the cost of the TMAH in the recycled base is very high compared to the cost of 4-ADPA. Efforts were made elsewhere to recover TMAH from the recycled base, but they were not industrially and practically successful. CECRI scientists developed a two-stage electrolysis method wherein the TMA ion is recovered into as an ultrapure TMA chloride (TMAC). The pure TMAC thus produced could be used to produce TMAH in a membrane electrolyzer. The process developed by CECRI is the first of its kind in the world. There are no patents or publications related to this invention.

Purification of recycled base (impure TMAH) in 500 ampere rating electralyser.

SSP-20/13

Evaluation of the protective life of Rustex–3 coating on maraging steel (MDN250) and 15CDV6 materials in marine environment

Division involved : Corrosion and Material Protection
Nodal Officer : Dr. M. Selvaraj
Sponsor : Vikram Sarabhai Space Centre, Thiruvananthapuram
Duration : December 2013 – December 2014
Budget : Rs 10 lakh

Objectives

- Evaluation of the protective life of Rustex–3 coating on maraging steel (MDN250) and 15CDV6 materials in marine environment.

Highlights

- The corrosion resistance of Rustex-3 coated maraging steel and 15 CVD6 panels was evaluated in mechanical tests, accelerated tests and electrochemical techniques. Exposure stand was erected in three sites and the coated maraging steel and 15CDV6 plates were exposed. The corrosion rates of the bare plates will be reported. The protective life of the Rustex-3 will be evaluated for a year.

SSP-21/13

Neutral paint remover to remove 400 micron thick zinc rich and epoxy coating system from maraging steel

Division involved	: Corrosion and Material Protection
Nodal Officer	: Dr. M. Selvaraj
Sponsor	: Vikram Sarabhai Space Centre, Thiruvananthapuram
Duration	: December 2013 – December 2014
Budget	: Rs 5 lakh

Objectives

- To develop a neutral paint remover to remove 400 micron thick zinc-rich and epoxy coating system from maraging steel.

Highlights

- A neutral paint remover was formulated and tested on coatings on maraging steel. It removed the coating in about one hour. Efforts are on to modify the formulation to reduce the time to 30 min.

ZRP + epoxy paint coated panel (left); neutral paint remover applied on surface (middle); coating lifted from the surface after 30 min (right).


CSIR
CONSULTANCY PROJECTS
CECRI

SPM PicoSPM Picoscan 2100 (Molecular Imaging)

CNP-02/13

On-condition survey of tank plates, pipes and structural steel in COGIL tank age project at the Cuddalore Refinery

Nodal Officer : Dr. M. Selvaraj
Sponsor : COGIL/ABIR, Cuddalore
Duration : May – July 2013
Budget : Rs 3.37 lakh

Objectives

- Advisory consultancy on condition survey of tank plates, pipes and structural steel on COGIL tanker project, Cuddalore.

Highlights

- A temporary coating system was suggested to protect the tank plates, pipes and other structural steels in the tankers project. The company has implemented the suggestion for the protection of the structure. On-the-spot investigation of the condition of the plates, pipes and tank structures in this project were made and suitable temporary protective measures were suggested for these structures.

Powder X-ray Diffractometer (XRD) PW3040/60 X'pert PRO (PANalytical)


CSIR
TECHNICAL SERVICES
CECRI

Scanning Probe Microscope (SPM) PicoSPM Picoscan 2100 (Molecular Imaging)

Technical Services Provided

TSP-01/13

Testing of CPCC-coated reinforcement rods and chemicals covered by the patent Nos. 481/Del/93 and 259/Del/92 as per CECRI code of practice (1 set of samples).

Division involved: Corrosion and Material Protection

Nodal Officer: Dr.R. Vedalakshmi

Sponsor: Omega Construction, Tirupur, Tamil Nadu

Duration: April–July, 2013

Budget: Rs 97,873

Objectives: Testing of CPCC-coated reinforcing bars used in the construction of gauge conversion of Tiruthuraipundi–Agastiampalli: Proposed reconstruction of minor bridges between Tiruthuraipundi and Agastiampalli stations.

Highlights: The quality of the CPCC treatment on rebars was assured, ensuring the durability of the structures in marine environment.

TSP-02/13

Vibration testing of 12 V/3 Ah VRLA battery as per manufacturer's instructions.

Division: Electrochemical Power Systems

Nodal Officer: Er. V. Muthumani

Member: Er. P. Seenichamy

Sponsor: Tractors and Farm Equipment Ltd., Chennai.

Starting date: September 2013

Budget: Rs 50,000

Objectives: Vibration testing of 12 V/3 Ah VRLA battery as per the manufacturer's instructions.

TSP-03/13

Testing of CPCC-coated reinforcement rods and chemicals covered by the patent Nos. 481/Del/93 and 259/Del/92 as per CECRI code of practice (5 sets of samples).

Division :Corrosion and Materials Protection

Nodal Officer: Dr. R. Vedalakshmi

Sponsor: Soma Enterprises Ltd., DFCC Project, Gujarat.

Duration: July–November, 2013

Budget: Rs 6,12,081

Objectives: To conduct screening tests as per CECRI code of practice on the CPCC-coated samples and chemicals collected from bridge No. 93 (2 sets of samples), bridge No. 99 (2 sets of samples) and bridge No. 136 (1 set of samples)

Highlights: The quality of the treatment of CPCC on rebars was assured, which ensures the durability of the structures in marine environment.

Conference/ seminar/ workshop attended (national & international: 3

Lectures delivered (at CECRI / outside CECRI): 1

TSP-04/13

Testing of CPCC-coated reinforcement rods and chemicals covered by the patent Nos. 481/Del/93 and 259/Del/92 as per CECRI code of practice (1 set of samples).

Division: Corrosion and Materials Protection

Nodal Officer: Dr. R. Vedalakshmi

Sponsor: United Construction Company, Thrissur, Kerala.

Duration: July–October, 2013

Budget: Rs 1,22,416

Objectives:Testing of the CPCC-coated reinforcing bars used in the construction of doubling of track between Mangalore and Panambur.

Highlights: The quality of the CPCC treatment on rebars was assured, which ensures the durability of the structures in marine environment.

TSP-07/13

Vibration testing of 12 V/3 Ah VRLA battery as per manufacturer's instructions.

Division: Electrochemical Power Systems

Nodal Officer: Er. V. Muthumani

Member: Er. P. Seenichamy

Sponsor: Tractors and Farm Equipment Ltd., Chennai.

Starting date: September 2013

Budget: Rs 50,000

Objectives: Vibration testing of 12 V/3 Ah VRLA battery as per the manufacturer's instructions.

TSP-10/13

To conduct an in-house training program on electroplating at INDO-MIM Aerospace Products Group, Doddaballapur, Bangalore.

Division: Electroplating and Metal Finishing Technology

Nodal Officer: Dr. G.N.K. Ramesh Bapu

Members: Dr. K.N. Srinivasan; Dr. R. Sekar and Mr. R. Rajasekar

Sponsor: INDO-MIM Aerospace Products Group, Doddaballapur, Bangalore.

Duration: March–December, 2013

Budget: Rs 2,09,570

Objectives: To conduct an in-house training program on plating for 20 participants at Aerospace Products Group, Bangalore (October 8 & 9, 2013).

Highlights: Four scientists visited the client's site for the training program. They delivered eight lectures and distributed course materials and certificates.

TSP-06/13, TSP-08/13, TSP-09/13, TSP-11/13 TSP-14/13 and TSP-16/13

Testing of CPCC-coated reinforcement rods and chemicals covered by the patent Nos. 481/Del/93 and 259/Del/92 as per CECRI code of practice (9 sets of samples).

Division: Corrosion and Material Protection

Nodal Officer: Dr. R. Vedalakshmi

Sponsor: Soma Enterprises Ltd., DFCC Project, Gujarat.

Duration: August 2013 to July 2014.

Budget: Rs 11,01,744

Objectives: To conduct screening tests as per CECRI code of practice on the CPCC-coated samples and chemicals collected from bridge No. 359 (2 sets of samples), bridge No. 93 (5 sets of samples) and bridge No. 358 (1 set samples) and bridge No. 144 (1 set of samples).

Highlights: The quality of the CPCC treatment on rebars was assured, which ensures the durability of the structures in marine environment.

TSP-17/13

Design and fabrication of 500 A rating electrolyzer for treatment of recycled base (impure TMAH) to TMA chloride.

Division: Chlor-Alkali

Nodal Officer: Dr. K. Subramanian

Member: Dr. G. Rajagopal

Sponsor: National Organic Chemical Industries Limited, Navi Mumbai, Maharashtra.

Duration: February–April, 2014.

Budget: Rs 2,00,000

Objectives: Design and fabrication of 500 A rating electrolyzer with IrO_2-TiO_2-coated titanium expanded mesh anode and titanium expanded mesh cathode.

Highlights: A 500-A electrolyzer with the electrodes were designed, fabricated and delivered at the plant site of NOCIL, Dahej. The electrolyzer for the purification of impure TMAH was designed to an electrolyte capacity of 55 litres and was fabricated using polystone material with inlet and outlet feed tubings. Two box-type rectangular anodes (40 cm x 35 cm) coated with RuO_2-IrO_2-TiO_2 catalyst on expanded titanium mesh; two rectangular expanded titanium mesh cathodes (40 cm x 35 cm) were assembled and provided with copper rods connectors. The cell was assembled with an inter-electrode gap of 1 cm and housed in the electrolyzer.

Electrolyser for treatment of impure TMAH to TMAChloride fabricated from polystone

Fabrication process for Titanium electrodes structurals by TIG welding

500A electrolyser with anades and cathodes for purification of recycled base to TMAC


CSIR
IN-HOUSE R&D PROGRAMS
CECRI

ICP-MS (Thermo Scientific)

OLP-001C

Electro-inorganic chemicals

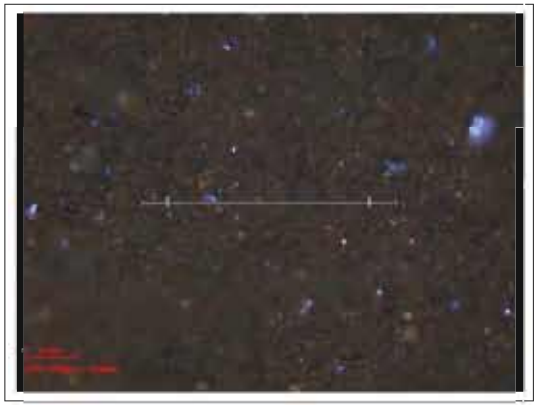
Division involved	: Electro-inorganic chemicals
Nodal Officer	: Dr. G. Sozhan
Members	: Dr. S. Vasudevan, Dr. D.J. Davidson, Dr. S. Ravichandran and Dr. S. Vengatesan
Sponsor	: CSIR-Central Electrochemical Research Institute
Duration	: April 2013 – March 2014

Objectives

- Semi-pilot scale studies on electrochemical defluoridation;
- Study on a gasoline-fueled S.I. engine with an addition of hydrogen and oxygen; and
- Solar-driven CO_2 reduction: conversion of CO_2 into liquid fuels.

Highlights

- A tank-type monopolar electrochemical defluoridator of 200 liters per hour capacity was fabricated with aluminium alloy anodes and GI cathodes. Experiments are conducted at various flow rates for standardizing parameters and conditions. The electrolyzer was operated for 8h/day. The performance of the electrolyzer is on par with the laboratory scale models.
- A PEM-based hydrogen generator was developed and studies were conducted with hydrogen generated by the electrolyzer to run a Honda petrol internal combustion engine. Hydrogen was stored in a metal hydride cylinder and supplied to the engine through the carburetor.
- Solar energy is considered to be one of the promising renewable energy sources for photovoltaic and photochemical processes. Utilization of solar energy to convert CO_2, a greenhouse gas, into useful fuels would reduce the global CO_2 level and replace demand for fossil fuels. The conversion of CO_2 into liquid fuels requires an efficient photocatalyst or electrocatalyst or a combination of both. Achieving this would be a challenging milestone. The main objective of this research is to develop efficient photocatalysts for the conversion of CO_2 into fuel under sunlight. Here, we propose a photocatalytic system with a combination of a photocatalyst and a sensitizer. CuO, CuO/TiO_2, Pt/TiO_2 were prepared and used as the



Optical micrascopic image of the photocatalytic system CuO/TiO_2,organic dye

An experimental setup for the reduction of CO_2

photocatalysts, while organic dyes were used as sensitizers. 3-D optical microscopic analysis of the prepared electrodes revealed the presence of dye particles distributed over the surface of the photocatalyst. CO_2 reduction was carried out in a closed reaction chamber. The products were analyzed by gas chromatography, which showed the formation of liquid hydrocarbons that are mostly low-boiling components.

OLP-0070

Brass Cluster: Development of environment-friendly brass and copper electrolyte

Division involved	: Electrochemical Metal finishing Technology
Nodal Officer	: Dr G.N.K. Ramesh Bapu
Members	: Dr L. John Berchmans, Dr. R. Sekar, Dr. S.K. Jha and Dr. G. Sreedhar
Sponsor	: DST and CSIR
Duration	: January 2012 – March 2014
Budget	: Rs 4 lakh

Objectives

- Development of an environment-friendly and stable brass electrolyte for plating on mild steel, stainless steel and aluminum substrate.

Highlights

- Developed a stable and environment-friendly brass electrolyte, and the technology transferred and demonstrated to Moradabad-based brass industry.

OLP-0067

DNA-based nanomaterials for catalysis, device and sensor applications

Division involved	: Electrochemical Materials Science
Nodal Officer	: Dr. Subrata Kundu
Sponsor	: CSIR-Central Electrochemical Research Institute
Duration	: August 2011 – August 2013
Budget	: Rs 8 lakh

Objectives

- Synthesis of DNA-based nanomaterials and nanowires using wet-chemical, UV-photoreduction and microwave heating methods.
- The focus was on mono-metallic and bi-metallic nanowires made from Au, Ag, Rh, Ir, Co and Bi, and semi-conductor nanomaterials such as CdSe, CdTe, etc.
- The synthesis processes followed mainly three steps: (i) metal ions are first complexed onto a DNA scaffold; (ii) the metal ions were then reduced to metal NPs; and (iii) the NPs or nanoclusters were specifically deposited on the DNA scaffold.
- Characterization of the nanomaterials and nanowires was done by UV-Vis, TEM, SEM, AFM, XPS, and XRD analyses. The products were evaluated for catalytic reactions, device applications and sensor applications.
- The capability of fabricating metallic and semi-conductor nanowires at ambient condition at room temperature with arbitrary topology offers interesting opportunities in electronics, catalysis and sensors.

Highlights

- The work already completed include: (i) shape-selective synthesis of magnetic cobalt oxide nanomaterials for environmental application in catalysis studies; (ii) a new route to Au nanowires and application of shape-selective Au NPs in SERS studies; (iii) self-assembly of DNA-templated aggregated Au NPs into nanowires and their enhanced SERS and catalytic applications; and (iv) synthesis of shape-selective curcumin-Ag NPs for SERS studies.

OLP-0068

Development of graphene-based high-performance counter electrodes for dye-sensitized solar cells

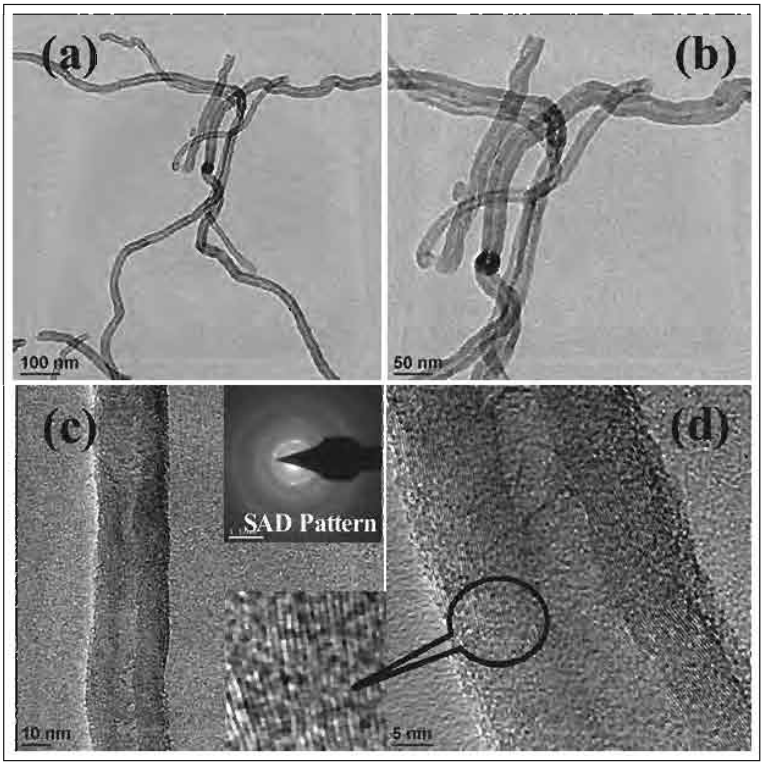
Division involved	: Electrochemical Materials Science
Nodal Officer	: Dr. R. Thangamuthu
Sponsor	: CSIR-Central Electrochemical Research Institute
Duration	: August 2011 – August 2013
Budget	: Rs 8 lakh

Objectives

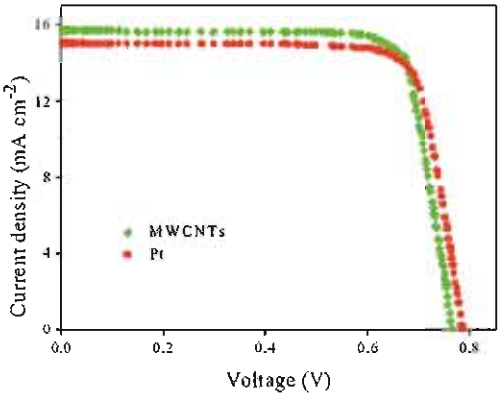
- Development of carbonaceous materials/ graphene coatings on substrates such as fluorine-doped tin oxide (FTO), indium tin oxide (ITO) conductive glasses and ITO-coated flexible substrates (e.g. polyethylene terephthalate);
- Characterization of carbonaceous materials/ graphene coatings by XRD, XPS, SEM and TEM;
- Evaluation of the electrocatalytic activity of carbonaceous materials/graphene coatings by cyclic voltammetry and electrochemical impedance spectroscopy; and
- Fabrication of DSSC devices using in-house developed carbonaceous materials/ graphene-based counter electrodes and evaluation of their performance and durability.

Highlights

- Well graphitized MWCNTs were synthesized over ordered cubic 3- mesostructure



HR-TEM Images and diffraction patterns of MWCNTs growth over 3D cubic Fe–Co–KIT-6



Photocurrent-voltage characteristics of DSSCs fabricated with MWCNT- and Pt-based counter electrodes.

bimetallic Fe-Co-KIT-6. The MWCNTs were fabricated onto transparent conducting oxide glass and implemented as an efficient low-cost, platinum-free counter electrode in DSSCs, which improved electrocatalytic activity towards iodide/tri-iodide (I^-/I_3^-) redox reaction over conventional Pt counter electrode. Impressively, device with the MWCNT counter electrode demonstrated a high fill factor of 0.79 and a power conversion efficiency of up to 9.56%, which are significantly higher than 0.78 and 9.34%, respectively, for a conventional Pt electrode. Moreover, the counter electrode showed a charge transfer resistance of 2.99 Ω cm^2 towards I_3^- reduction, which is lower than that of standard Pt counter electrode (3.57 Ω cm^2). Therefore, the MWCNT counter electrode can be considered for improving the power conversion efficiency of iodine redox couple-based DSSCs.

OLP-0070A

Investigations on cyanide-free electroplating techniques and novel anti-tarnishing methods for better finishing of brass products and other material

Division involved	: Electrochemical Metal finishing Technology
Nodal Officer	: Dr G.N.K. Ramesh Bapu
Members	: Dr L. John Berchmans, Dr. R. Sekar, Dr. S.K. Jha and Dr. G. Sreedhar
Sponsor	: CSIR-Central Electrochemical Research Institutel

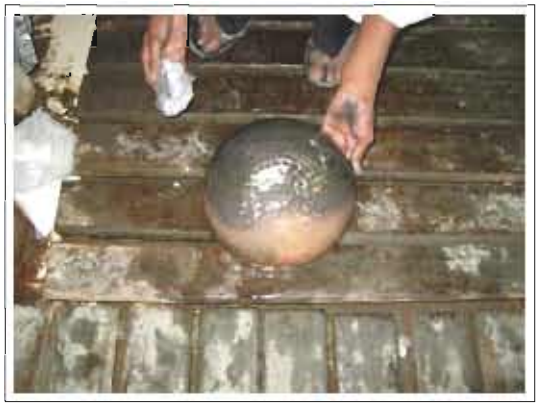
Objectives

- Replacement of cyanide copper electrolytes with economically viable, environment friendly cyanide free electrolytes for finishing of brass and steel products;
- Development of brass plated products as a substitute for brass substrate products with improved quality and better finishing options; and
- Offering training facilities for up-gradation of skills of floor level plating shop persons and technicians so as to increase their employment/ business and improve their standards of life in the society.

Highlights

- Developed a cyanide-free brass electrolyte for plating on steel, stainless steel and aluminium. The deposit was characterized for alloy composition and corrosion resistance. Demonstrated the cyanide free brass plating process at Moradabad during October 2013. About 30 exporters, electroplaters and artisans participated in the demonstration. Indian Industries Association in collaboration with MCIDS arranged the meeting at Kumar International, Moradabad. A cyanide-free brass-plated memento was presented to the Union Finance Minister during his visit to CECRI on July 27, 2013. A brochure on Brass Cluster activities was published and circulated to MSME centres.

DG-CSIR and Director, CSIR-CECRI presenting a brass-plated memento to Finance Minister Mr. P. Chidambaram




अमर उजाला

साइनाइड फ्री प्लेटिंग अच्छी पर 'नंबर 1' नहीं

A demonstration to about 30 exporters, electroplaters and artisans at Moradabad

OLP-0074

A novel approach to improve the oxidation and hot corrosion resistance of thermal barrier coatings

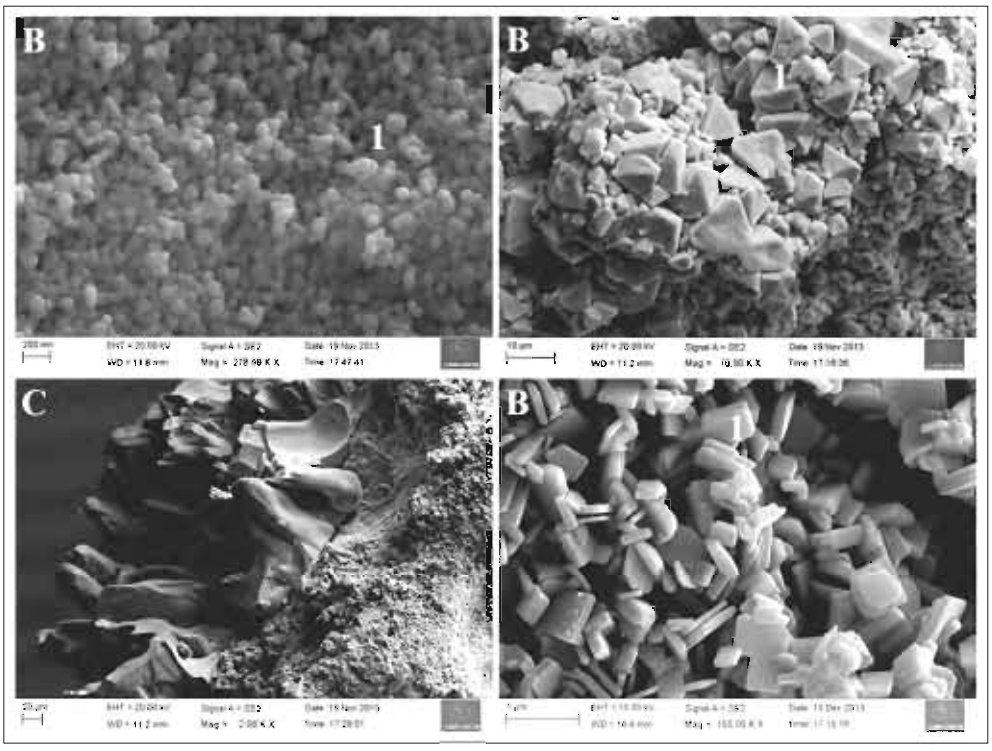
Division involved : Electropyrometallurgy
Nodal Officer : Dr. G. Sreedhar
Sponsor : CSIR-Central Electrochemical Research Institute
Budget : Rs 4 lakh

Objectives

- To improve the oxidation- and hot corrosion resistance of thermal barrier coatings.

Highlights

- Different perovskites were tested their hot corrosion stability. $SrTiO_3$ was found to be unstable in hot corrosive environments. Hot corrosion studies with double perovskites are on.



Surface morphology of $SrTiO_3$ before and after exposing ta hot corrosion environs

OLP-0075

Development of alkaline anion exchange membranes with high ionic conductivity and improved stability for electrolyzer applications

Division involved	: Electro-inorganic Chemicals
Nodal Officer	: Dr. S. Vengatesan
Sponsor	: CSIR-Central Electrochemical Research Institute
Duration	: May 2012 – April 2014
Budget	: Rs 4 lakh

Objectives

- To develop anion exchange membranes with high ionic conductivity and stability;
- to investigate the applicability of the membranes in the presence of non-noble metal catalysts in water electrolyzer systems

Highlights

- Aromatic hydrocarbon-based anion exchange membranes were prepared from vinyl monomers and characterized by NMR, FT-IR, TGA and SEM analyses. Membranes with good ionic conductivity and stability were formed. The membranes were tested with a non-noble metal catalyst in electrolyzer systems. The synthesis of the anion exchange polymer was realized with vinyl monomers using free radical polymerization. It involved the synthesis of styrene-co-VBC polymer and subsequent quaternization and alkali exchange steps. ^{1}H-NMR, FT-IR, TGA and GPC analyses confirmed the quaternary ammonium-functionalized anion exchange polymers. The membranes were fabricated using the anion exchange polymers and it showed conductivity in the range of 10^{-3} to 10^{-2} S/m. A membrane-electrode-assembly (MEA) was fabricated with the membrane and nickel foam catalyst. A single cell was assembled and tested for water electrolysis. The cell sustained a current density of 50 mA/cm^2 at 2.0 V and 65°C.

OLP-0076

Design and development of novel metal carbide/nitride decorated metal oxide (precious and non-precious) catalysts for water oxidation and oxygen reduction reactions

Division involved	: Electrochemical Materials Science
Nodal Officer	: Dr. S.M. Senthil Kumar
Sponsor	: CSIR-Central Electrochemical Research Institute
Duration	: May 2012 – April 2014
Budget	: Rs 4.5 lakh

Objectives

- Evaluation of novel supports such as WC, TiC and TiN for anchoring/decorating metal oxide catalysts (RuO_2, IrO_2, Co_3O_4, NiO, MnO_2, Fe_2O_3) prepared by different routes (hydrothermal, sol-gel, electrochemical);
- Physical and chemical vapor deposition of layer-by-layer of metal carbide/nitride and metal particles on fluorine-doped tin oxide and indium tin oxide conductive glasses; and
- Physico-chemical characterization and electrocatalytic studies of the above composites for OER (oxygen evolution reaction) and ORR (oxygen reduction reaction) under acidic and alkaline conditions.

Highlights

- MnO_2 catalyst was anchored on WC,TiN, CNT surfaces and characterized by XRD, TEM and SEM. Its efficacy for OER has been carried out in alkaline medium. Catalyst supports such as WC, TiC and TiN have attracted considerable attention because they are cost-effective, resistant to corrosion and are good conductors. A method has been developed for anchoring/decorating metal oxide catalysts on them. The new catalysts are stable under alkaline condition and are effective towards OER.

OLP-0077

Development of graphene-based nanomaterials for high energy supercapacitor applications

Division involved	: Functional Materials
Nodal Officer	: Dr. M. Sathish
Sponsor	: CSIR-Central Electrochemical Research Institute
Duration	: May 2012 – April 2014
Budget	: Rs 4.9 lakh

Objectives

- To develop functional materials-decorated graphene nanosheets (GNS) using chemical modification/ functionalization of GNS surface and to study their application in supercapacitors; and
- To synthesize N-doped GNSs using various N-containing organic compounds and to evaluate their application in high-energy supercapacitors.

Highlights

- A simple, economical and facile process for the synthesis of nitrogen-containing graphene composite was prepared using graphene oxide and polypyrrole as precursors. Electron microscopic images confirmed the formation of nanosheets. Raman and FT-IR spectroscopic analyses revealed the presence of N-containing functional groups in N-doped graphene. XPS analysis confirmed the chemical nature of N in the graphene sheets, while CHN analysis showed the amount of N-doping in graphene. The material exhibited a specific capacitance of 286 F/g at 0.1 A/g with high capacitance retention and long-term electrochemical stability.

OLP-0089

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

Division involved	: Functional Materials
Nodal Officer	: Dr. N. Lakshminarasimhan
Member	: Dr. M. Sathish
Sponsor	: CSIR under Young Scientist Award scheme
Duration	: June 2013 – May 2018
Budget	: Rs 25 lakh

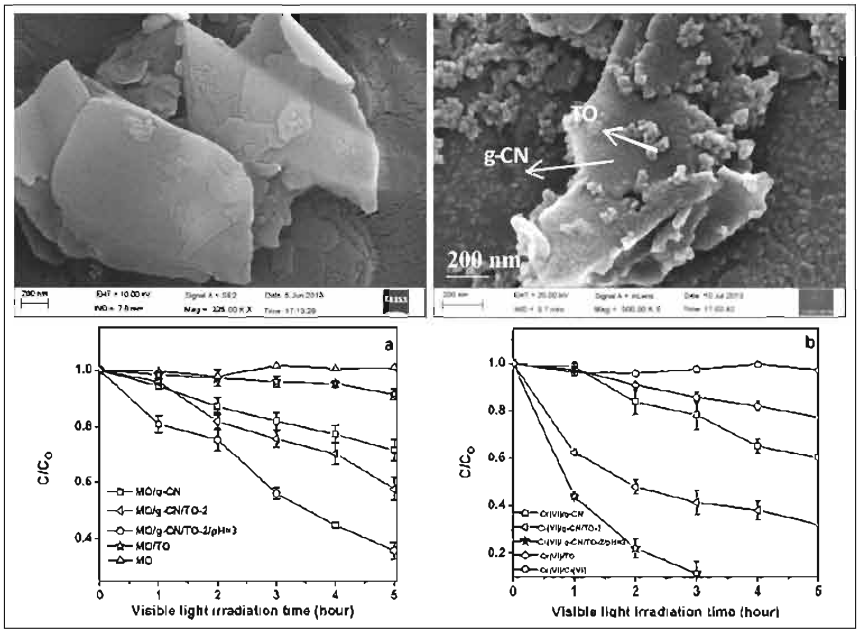
Objectives

- Design and development of graphitic carbon nitride ($g\text{-}C_3N_4$) and its composites with metal nanoparticles and/or metal oxides for electrochemical, photoelectrochemical and photocatalytic applications.

.

Highlights

- Pristine and $g\text{-}C_3N_4$ composite with TiO_2 nanoparticles were synthesized, characterized and their photocatalytic properties were examined. $g\text{-}C_3N_4$ sheets and TiO_2 nanoparticles dispersed over $g\text{-}C_3N_4$ exhibited high photocatalytic activity under visible light towards the degradation of methyl orange and reduction of Cr (VI) to Cr (III).



Comparison of visible light photocatalytic activities of $g\text{-}C_3N_4$ and $g\text{-}C_3N_4/TiO_2$ composites towards degradation of (a) methyl orange (left) and reduction of Cr (VI) (right).

MLP-003A

Studies on marine corrosion and bio-fouling on metals, alloys and materials and performance of concrete and building materials in marine environment

Division involved	: OPMEC, Tuticorin
Nodal Officer	: Dr. G. Subramanian
Members	: Dr. S. Chellammal, Dr. S. Palanichamy, Mr. P. Ganapathy, Ms. P. Kalaiselvi & Mr. C. Sivam
Sponsor	: CSIR-Central Electrochemical Research Institute
Budget	: Rs 5 lakh

Objectives

- To study the relation between corrosion and fouling on engineering alloys;
- To investigate the galvanic interactions of metals and alloys in marine atmosphere; and
- To develop an effluent treatment system for the process stream of organic solvents production plant – towards practical implementation of bio- electrochemical reactor.

Highlights

- The corrosion behaviour and bio-fouling characteristics of coupns of mild steel and high-strength low-alloy were studied over a period of 24 months simultaneously at three different coastal locations in the Gulf of Mannar, which is first of its kind in the literature of Indian waters. The corrosion behaviour and bio-fouling characteristics of high strength low alloy steel coupons were studied over a period of 24 months simultaneously at three different coastal locations in the Gulf of Mannar, India, which is first of its kind in the literature of Indian waters. The galvanic corrosion behaviour of aluminium 3004 and copper with different area ratios as well as aluminium 3004-α brass were studied in the tropical marine atmosphere at Tuticorin harbour over a period of 426 days. Conversion of the non-biodegradable aromatics of the solvent processing wastewater into biodegradable organic molecules by electro-oxidation and optimization of the electrolysis conditions for maximum removal of organics at different conditions of temperature, *p*H, current density and wastewater concentration on the performance of the electrochemical reactor and evaluation of the bio-compatibility (toxicity and biodegradability) of the electrochemically treated solutions.
- Barnacle fouling was predominant both at Mandapam and Tuticorin harbor whereas oyster fouling was predominant at Tuticorin open sea. The bryozoan foulers inhibited other macro fouling species. The fouling assemblage acted as a barrier and reduced the corrosion rate over a period of time. Thus, the corrosion rate and fouling load data exhibited a statistically significant negative correlation. The rate of corrosion for 24 months exposure period was highest at Mandapam, where fouling was minimal. Hard foulers like oyster and barnacle, induced crevices which resulted in the loss in ultimate tensile strength of mild steel. Among the three test locations, the loss in ultimate tensile strength of mild steel was maximum at Tuticorin open sea.
- Oyster fouling was predominant in the Tuticorin open sea, while barnacles were the major foulants at Tuticorin harbour and Mandapam. The fouling load in the Tuticorin

waters was higher as compared to the Mandapam waters. The corrosion rates showed a decreasing trend with time at all the three test locations. In the Tuticorin open sea, the corrosion rates were higher as compared to the other two locations throughout the study period. The surface of the coupons was characterized by crevices beneath hard foulers at Tuticorin harbour and Mandapam, whereas in the Tuticorin open sea the coupons experienced crevices of a tunneling nature. The percentage loss in ultimate tensile strength increased with time at all the test locations and was at maximum in the Tuticorin open sea. The presence of relatively higher amounts of chromium, nickel and aluminium in the HSLA steel matrix is believed to be the causative factor for the crevice corrosion. As a result, the HSLA steel of this composition is not suitable for seawater applications.

- The relative increase in the corrosion rate of aluminium in galvanic contact with copper can be ranked in the descending order: 1:8 > 1:4 > 1:2 > 1:1 > 2:1 > 4:1 > 8:1, and the relative decrease in the corrosion rate of copper in galvanic contact with aluminium can be ranked in the descending order: 4:1 > 2:1 > 8:1 > 1:1 > 1:2 > 1:8 > 1:4, for 426 days of exposure. The most favourable area ratios of aluminium-copper in marine atmosphere in terms of weight loss corrosion rate and pitting corrosion are 4:1 and 8:1. The most unfavourable area ratios of aluminium-copper in marine atmosphere in terms of weight loss corrosion rate and pitting corrosion are 1:1, 1:2 and 1:4. Pitting corrosion on aluminium in galvanic contact with copper is predominantly decided by the formation of compounds such as, Al_2O_3, AlO(OH) and $AlCl_3$ at the interface of aluminium-copper, as influenced by the aggressiveness of the environmental pollutant, caused by the prevailing weathering conditions and monsoon winds. Aluminium in galvanic contact with copper experienced severe pitting to the extent of perforation, which is predominant as the duration of the exposure extends. In general, it is detrimental to aluminium when it is in galvanic contact with copper in marine atmosphere. For 426 days of exposure, the pitting factors of aluminium in aluminium-copper for area ratios of 1:1, 1:2, 1:4, 1:8, 2:1, 4:1 and 8:1 were 2.6, 2.2, 3.1, 2.4, 1.9, 1.8 and 1.8, respectively. Thus the durability of aluminium is brought down by a factor of 2 to 4 due to galvanic coupling with copper. The shifting of galvanic potentials towards nobler direction is indicative of the protective nature of the corrosion products at the interface of the bimetallic contact.
- The most favourable area ratio of aluminium-$\propto$ brass in marine atmosphere in terms of gravimetric corrosion rate is 8:1 and the most unfavourable area ratio of aluminium-$\propto$ brass is 1:4. Aluminium in galvanic contact with $\propto$ brass experienced severe pitting to the extent of perforation, which is predominant as the duration of the exposure extends (Fig.6). The durability of aluminium is brought down by a factor of 2.5 to 4 due to galvanic coupling with $\propto$ brass. The pitting factor observed for galvanically coupled aluminium of aluminium-$\propto$ brass is higher than that of the aluminium of galvanically coupled aluminium-copper.
- The electrochemical treatments of the process stream of organic solvent synthesizing plants were investigated using three different anodes: RuO_2-IrO_2-SnO_2-TiO_2, IrO_2-Ta_2O_5 and graphite. RuO_2-IrO_2-SnO_2-TiO_2 and IrO_2-Ta_2O_5 were prepared by the thermal decomposition method. The COD removal efficiency is very low at graphite compared to those at the MMO electrodes. Due to chlorine evolution graphite surface was etched and carbon particles accumulated in the reaction vessel during prolonged electrolysis. Among RuO_2-IrO_2-SnO_2-TiO_2 and IrO_2-Ta_2O_5, the former exhibited excellent electro-catalytic activity

together with chemical stability during the effluent treatment. At *p*H 9, a higher COD removal (81%) was achieved with minimum energy consumption (8.1 kWh/ kg), with the removal of COD at 5 A/dm^2 at RuO_2-IrO_2-SnO_2-TiO_2 during the treatment of the process stream as such (without adding any chemicals) owing to the generation of hypochlorous acid/hypochlorite species which are strong oxidants towards organic species. Whereas at *p*H 7, the overall rate of COD removal was less on both MMO electrodes due to the chemical reaction between hypochlorous acid and hypochlorite, and hence the concentration of oxidants required for the indirect oxidation is low. Thus it is stated that alkaline conditions appear to favor COD conversion for the oxidation of organics of the effluent. After achieving the maximum COD removal by electrochemical method, the treated effluent was subjected to biological treatment using microbes (CECRI-1 and CECRI-II) isolated from the marine source. In biological oxidation, further COD removal efficiencies of 90% and 75% were achieved by using the above two microbes respectively. The above results show that the coupling of electrochemical and biological stages might prove a judicious choice for the remediation of industrial waste water contains recalcitrant compounds.

OLP-0084

Facile synthesis of metal oxide coatings and their applications for corrosion prevention in biodiesel engines

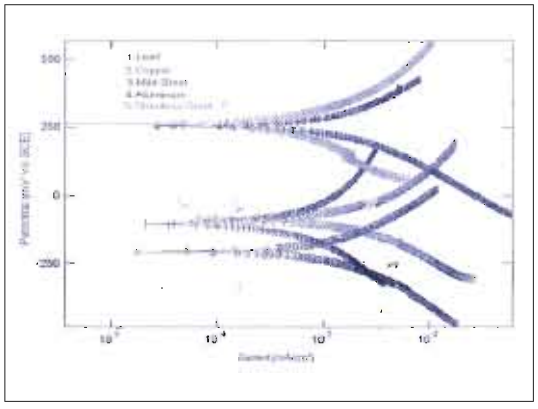
Division involved	: Corrosion Protection, Electroplating and Metal Finishing Technology, Electrochemical Power Sources
Nodal Officer	: Dr. D. Jayaperumal
Members	: Dr. S. Muralidharan, Dr. M. Paramasivam and Dr. Naveen Chandrasekaran
Sponsor	: CSIR-Central Electrochemical Research Institute
Budget	: Rs 15 lakh

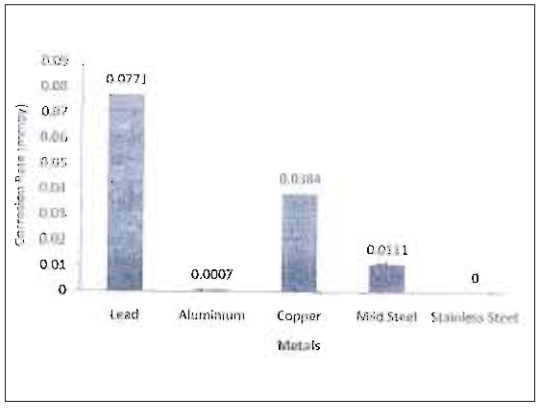
Objectives

- Facile synthesis of metal oxide coatings and their applications for corrosion prevention in biodiesel engines.

Highlights

- The following studies were carried out. Corrosion studies of base metal such as MS., S.S, Al, Cu and Pb were carried out. Metal oxide coatings such as CeO_2, $CeVO_4$, $FeVO_4$ and $SmVO_4$ were prepared on different substrates such as Cu, Al and MS. The coating thicknesses were 1.5–2.0 µm. The crystalline phases were confirmed by XRD. Of all the metals, lead exhibited the highest weight loss (165 mg) while stainless steel suffered practically no weight loss.





OLP-0086

Synthesis of multi-functional catalyst support materials

Division involved	: Corrosion and Materials Protection
Nodal Officer	: Dr. Sundar Mayavan
Sponsor	: CSIR-Central Electrochemical Research Institute
Duration	: April 2013 – April 2015
Budget	: Rs 3 lakh

Objectives

- To synthesize graphene nanosheets by chemical route;
- Surface characterization of graphene;
- To create hybrid structures with graphene materials; and
- To demonstrate the usefulness of the structure for catalysis.

Highlights

- Graphene, and hybrid structures involving graphene, CNTs and boron carbon nitride were synthesized and characterized by SEM, TEM and Raman spectroscopy.

OLP-0087

Development of ultra-low density macroscopic sponges from 2-dimensional nanomaterials for energy and environmental applications

Division involved	: Functional Materials
Nodal Officer	: Dr. T.N. Narayanan
Sponsor	: CSIR-Central Electrochemical Research Institute
Duration	: April 2013 – March 2015
Budget	: Rs 7 lakh

Objectives

- To synthesis of 2-D nanoflakes of graphene, doped graphene, MoS_2 and h-BN;
- To optimize synthesis and characterize the materials;
- To develop covalently connected sponges from the layered materials; and
- To apply these materials in energy and environment related fields.

Highlights

- The synthesis of 1-2 layered MoS_2 nanosheets was carried out. The material was used for selective enzymatic and non-enzymatic biosensing. Fluorinated graphenes with varied fluorine contents were made and their electron transport properties were studied. A mechanism for the enhanced electron transfer properties of fluorinated graphene was proposed.

OLP-0088

Graphene-based electrochemical nanobiosensors for applications in point of care diagnostics

Division involved : Bio-electrochemistry
Nodal Officer : Dr. A. Subbiah
Sponsor : CSIR-Central Electrochemical Research Institute
Duration : April 2013 – April 2015
Budget : Rs 3.5 lakh

Objectives

- To synthesize graphene nanosheets by chemical route;
- To surface-characterize graphene;
- To employ the graphene materials to detect tumor markers; and
- To demonstrate the usefulness of the electrode to detect tumor markers in the patient sample.

Highlights

- Graphene was synthesized and characterized by SEM, TEM and Raman spectroscopy. Few-layer (up to four) MoS_2 was synthesized and its usefulness for electrochemical biosensing with and without enzymes was demonstrated. We have also demonstrated a green route for the synthesis of biocompatible graphene.

OLP-0090

Modified anion exchange membranes for alkaline polymer electrolyte fuel cells

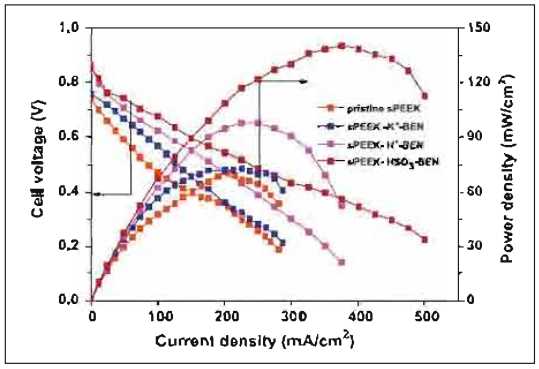
Division involved	: CECRI Madras Unit
Nodal Officer	: Dr. Santoshkumar D. Bhat
Sponsor	: CSIR Young Scientist Award Scheme
Duration	: January 2014 – December 2018
Budget	: Rs 25 lakh

Objectives

- Fabrication of anion exchange membranes for APEFCs.

Highlights

- Composite membranes comprising functionalized bentonite (HSO_3-BEN)-sulfonated poly(ether etherketone) (sPEEK) was fabricated as an alternative polymer electrolyte membrane for direct methanol fuel cells (DMFCs). K^+-bentonite was functionalized through silane condensation to introduce organo sulfonic acid groups. Ion-exchange capacity, sorption and proton conductivity for the composite membranes were investigated. These composite membranes were also characterized for their mechanical and thermal properties. DMFCs employing sPEEK-HSO_3-BEN composite membrane delivered peak power density of 140 mW/cm^2 while a peak power density of 71 mW/cm^2 was obtained for the DMFC employing pristine PEEK membrane at 70°C.



Cell polarization studies for DMFCs with pristine sPEEK and composite membranes at 70°C.

SEM S-3000H (Hitachi)


CSIR
TAILPIECE
CECRI

Ion chromatograph (Metrohm)

STS-2A

ज्ञान स्रोत केंद्र - ई-पुस्तकालय

KNOWLEDGE RESOURCE CENTRE
e-Library

Expertise

Information Science

- Literature survey and Patent search.
- Impact factor and Scientific Impact analysis.
- Computer Applications
- Development and management of Websites, Repositories, Blogspots, Forums etc.
- DTP-creation/design/layout of journal, reports, proceedings, brochures, posters, handouts, presentations, schematics etc.

Highlights

- Technical support rendered for various conferences/workshops/seminars in designing posters, websites, brochures, abstracts, souvenirs, certificates, etc.
- Brochure on Marine Corrosion and Biofouling Expertise at CECRI was designed.
- Brochure on Brass Cluster Activities at CECRI was designed.
- Website of e-Library was updated with new features.

STS-2B

ज्ञान स्रोत केंद्र - सामान्य पुस्तकालय

KNOWLEDGE RESOURCE CENTRE - Physical Library

The library is a storehouse of knowledge. CECRI library has a unique collection with ample resources in the areas of electrochemistry and its allied fields. Since its inception in 1953, ilt has been catering to the needs of its scientists, research scholars, students and staff of the institute for their research and academic activities.

The library uses computerization for circulation of books and journals. Functions like acquisition, cataloguing and circulation have been automated using LibSys software. It uses OPAC (online public access catalogue) by which users can view availability and status of documents in the library, and browse the resources on their desktop through intranet.

Collection

The library has a rich collection of books, journals, patents, standards, theses and other documents of research value. Currently, the library subscribes to about 90 journals of which 70 are international. Apart from subscribed journals, the library also get journals through exchange and gift. To-date, the library resources stand at over 48,000 volumes of books and back volumes of journals and more than 10,000 other scientific documents such as theses, patents, standards and other documents of research and academic value. The library follows arrangements of books according to the standard edition of Universal Decimal Classification (UDC) system. During the period 2010-2011, 92 books and monographs were procured.

Apart from print resources, the library plays a unique role in providing access, delivering service, with more than 2000 scholarly electronic journals through CSIR e-Journals Consortium. The CSIR e-Journals Consortium provides access to world's leading S&T literature published by scientific publishers such as Elsevier, Springer, John Wiley, Taylor and Francis, Oxford University Press, Nature Publishing Group, AAAS, American Institute of Physics, American Chemical Society and Royal Society of Chemistry. The e-library has access to the entire content of publications from the Electrochemical Society, USA. It also facilitates access to secondary databases such as Web of Science - the web-enabled bibliographic database that covers all mainstream journals in all fields of science and technology, and Delphion and Derwent Innovation Index, a comprehensive value added patent information with the citations. The library has a stand-alone access to the electronic version of ASTM Standards.

Moreover, as an institutional member of the Electrochemical Society Inc., USA and the International Society of Electrochemistry, Switzerland, the library has online access to the contents of their publications.

Services

The main function of the library is to provide information services and access to bibliographic and full text digital and printed resources to support scholarly and informational needs of CECRI scientists and research scholars. The library serves as a knowledge centre for the students of B.Tech at CECRI. It has an in-house bindery and reprographic facilities.

The library also facilitates exchange of journal articles among laboratories through JCCC service under the CSIR e-Journals' Consortium. Document supply service is also made available

from other laboratories and NISCAIR, New Delhi if the user is willing to bear the expenses involved.

Besides, it provides photocopying service on request for nominal charges. This is done according to the copyright rules.

Reference service

The library has a unique collection of reference materials. Reference queries are responded to immediately by qualified library professionals.

Library hours

The library functions on all working days from 9.00 a.m. to 5.30 p.m and on Saturdays from 10.00 a.m. to 2.00 p.m. It remains closed on Sundays and government holidays.

Recognition

The library is a recipient of "The Leadership Circle Award" (Silver Level) of the Electrochemical Society, USA for CECRI's continuous support and contribution as a member of the Society over 15 years. The library holds an entire collection of Chemical Abstracts (print) from 1927 to 2005 and is named as one of the Signature Libraries by The American Chemical Society, USA.

STS-003

TECHNOLOGY TRANSFER AND BUSINESS DEVELOPMENT

Dissemination of Technical Information

Technical and non-technical information on institute's programs and activities; release of advertisements for souvenirs; responding to parliament queries; response to queries from various corners (government and non-government agencies).

Database Management

CSIR-CECRI patent library, technologies developed and technologies transferred; projects, patents, staff, research fellows, budget, ECF, awards and honors, conferences/symposia/seminars/workshops.

IPR Management

Protection of innovations; coordination for filing and grant of Indian and foreign applications/patents; recommendations for renewal of patents/ commercialization status; maintenance of information on IP system/surveillance; response to queries on IP-related issues; IP management; repository holding for all research papers published in CSIR-CECRI.

Patents Filed

1. Titania based mixed oxide semiconductor photo anode preparation by pneumatic impregnation for photo electrochemical generation of hydrogen. – Davidson DJ, Ravichandran S., Sozhan G., Vasudevan S. Ref. No. 0043NF: 2013

2. Brass plating from low temperature molten salt electrolyte – Shanmugasigamani K., Selvam M. Ref. No. 0066NF: 2013

3. Porous metal oxide composite anode materials for high energy Li-ion battery applications. Jayachandran M., Stephen A M., Panda A B. (CSMCRI), Sutradhar (CSMCRI), Thangamuthu R., Subramanian B., Senthilkumar S M., Bajaj De., (CSMCRI). Ref. No. 0067NF: 2013

4. A zinc bromine redox flow battery with improved performance. Suresh S., Munaiah Y., Ragupathy P., Vijayamohanan K Pillai, Deenadayalan S. Ref. No. 0110NF: 2013

5. Improved lithium intercalation behavior of Li. 0.4 Co 0.2 O2 cathode with novel surface modifiers. Kalaiselvi N., Bhuvaneswari D., Gangulibabu. Ref. No. 0149NF: 2013

6. Metal organic frame work laders nano composite polymer electrolytes for all solid state lithium batteries. Manuel Stephen A., Angulakshmi N., Senthilkumar R., Anbukulandainathan M. Ref. No. 0150NF: 2013

7. Novel synthesis protocol and modified phosphate electrodes for lithium batteries. Kalaiselvi N, Nithya K, Chandrasekar B, Mani V. Ref. No. 18-20-06(04/2013)-TTBD

8. Electropolishing of copper and stainless steel into low temperature molten salt electrolyte. Shanmugasigamani K, Selvam M. Ref. No. 18-35-06(05/2013)-TTBD

9. An improved eco-friendly process for removal of corrosion products on aluminium and aluminium alloys by electrolyte clearing using natural sea water. Subramanian G, Palraj S, Ravishankar R, Palanichamy S. Ref. No. 0289NF2013 / 18-44-06(06/2013)-TTBD

Intellectual property licensed: (as technology transferred)

No.	Title	Licensee	Terms of licence	Effective date of license
1	Corrosion resistant inhibitive admixture for Portland Pozzalona cement	Clean Tech Corrosion Chemicals, Hyderabad	LP: Rs S lakh + ST RR: Nil PL: 7 years NL: Non-exclusive	13.11.2013
2	Electrochemical technology for the recovery of tetramethyl ammonium content as pure tetramethyl ammonium chloride from impure tetramethyl ammonium hydroxide	NOCIL, Navi Mumbai	LP: Rs 3 lakh + ST RR: Nil PL: 5 years NL: Non-exclusive	19.03.2014

Technology tronsfer to M/s. NOCIL Limited, Novi Mumboi on 19/03/2014

STS-004

PROJECT PLANNING & MONITORING GROUP

PME activities

Preparation of 12th Five Year Plan projects; preparation of R&D highlights documents and Director's RC- and MC-related presentations; planning, monitoring and reporting of budgets for in-house, network and external projects; organization of monthly/quarterly/six-monthly/annual project monitoring meetings for centrally-funded network and in-house projects.

Coordination with the CSIR/CAG audit towards the performance audit of 11th Plan projects, in-house and externally-funded projects; Centralized management of all project files; development and launching of online project management software [ERP]; processing of indents and their display every month on Intranet & ERP portal; preparation of monthly reports; Coordination of NMITLI and TAPSUN mega projects.

HR Activities

Organization of orientation programs for newly recruited staff of the institute; updation of guidelines structured for training programs at the institute; framing new guidelines for participation of research fellows of CECRI in conferences/symposia/seminars/workshops held in India and abroad; organizing CSIR program on CSIR-800 admiration program in science; processing of staff nominations for honours and awards, fellowships and training programs; processing of requests of staff and research fellows for participation in various fora.

Institutional publications

CSIR-CECRI Annual Report 2012-13; and CSIR-CECRI Newsletters (two issues).

STS-004

INTERNATIONAL COLLABORATION & PUBLICITY

Coordination of institute scientists' deputations abroad under different programs; coordination of distinguished foreign visitors to the institute; coordination of foreign students under various international fellowships; coordination of important events held in the institute; coordination of advertisements and publicity in newspapers, e-information and digital communication media; coordination of analysis of research samples provided to external users such as academic and R&D institutions.

Societal activities

Coordination of a CSIR-sponsored program on Faculty training, motivation and adoption of schools & colleges in 2012; implementation of rural development programs for rural villages.

Right to information

This activity is 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.

Deputations abroad

Dr. S. Angappan Senior Scientist	Slovak Republic Scholarship in Slovak Republic for Researchers	May 14, 2013 – August 11, 2014
Dr. S. Gopukumar Senior Principal Scientist	Wisconsin-Milwaukee, Canada, USA To chair a session at the 223rd ECS Meeting	May 12–21, 2013
Dr. D. Vasudevan Principal Scientist	CSIRO, Australia Visiting Researcher	June 10, 2013 – September 28, 2013
Mr. R. Ravikumar SRF	7th International Conference on Materials for Advanced Technologies	June 30, 2013 – July 5, 2013.
Dr. A.S. Prakash Senior Scientist	IFBAM, Bremen, Germany Collaborative research under CSIR-BMBF	August 6–27, 2013
Dr. Sheela Berchmans Chief Scientist	USA Fulbright Nehru Senior Research Fellowship	September 12, 2013 – May 2, 2014.
Dr. K. Ramesha Senior Scientist	IFBAM, Bremen, Germany Collaborative research under CSIR-BMBF	October 4–28, 2014

Deputations abroad...

Dr. A.S. Prakash Senior Scientist	College De France, Paris Visiting Professorship	November 11, 2013 – August 31, 2014.
Dr. S. Gopukumar Senior Principal Scientist	7th Asian Conference on Electrochemical Power Sources in Japan and discussion with Prof. S. Okada	November 21–27, 2013
November 21–27, 2013 Dr. S. Maruthamuthu Senior Principal Scientist	Malaysia USM-TWAS Visiting Researcher Fellowship	January 1, 2014 – March 31, 2014.
Dr. V. Suryanarayanan Scientist	Taiwan Indo-Taiwan Joint Research Program	January 3–12, 2014
Dr. J. Mathiyarasu Principal Scientist	University of California, USA Raman Research Fellowship	January 6, 2014 – February 28, 2014

International visiting researchers

Mr. Mochammad Syaiful Anwar Researcher, Institute of Sciences, Indonesia (under the Research Training Fellowship for Developing Country)	June 3 to November 3, 2013. On light-weight conductive cements mortar anode for cathodic protection of steel in concrete structures. Mentor: Dr. R. Vedalakshmi.
Ms. Aphouet Aurlie Koffi Cote D' Ivoire (under the CSIR-TWAS Sandwich Post Graduate Fellowship)	July 4, 2013 to July 3, 2015. On Corrosion inhibitors for copper, aluminium and iron in acid media. Mentor: Dr. S. Muralidharan.

Dissertations

139 MSc/MPhil/ME/MTech students (Chemistry, Physics, Biotechnology, Nanotechnology, Structural Engineering & Environmental Engineering) from institutions across South India completed their academic project works at CSIR-CECRI.

STS-004

SEMINAR AND TRAINING (S&T)

Deputation to conferences/seminars/workshops

Program	Date and venue	Participant(s)
National Seminar on Traditional Knowledge and Practices for Sustainable Development	April 15, 2013 Bhuvaneswar	Dr. S.M. Rajendran, Dr. K. Radhakrishnan
Students' Seminar on Metallurgical Engineering –Behind the Teacher's Desk	April 5&6, 2013 Jamshedpur	Mr. R. Rajapandian, Mr. M. Mohamed Hanifa (BTech students)
International Conference on Energy Efficient Technologies for Sustainability on Electrolysis: Inevitable Energy Transformer in a World of Sustainable Energy	April 10–12, 2013 Nagercoil	Dr. S. Vasudevan
223rd Electrochemical Society Meeting	May 12–16, 2013 Toronto, Canada	Dr. S. Gopukumar
Workshop on Renewable Energy	May 9–11, 2013 Chennai	Dr. M. Selvaraj, Mr. G. Anandaraj

Conferences cont...

Program	Date and venue	Participant(s)
National Symposium on Recent Advances in Cyber Security	June 6&7, 2013, Bangalore	Dr. G. Radhakrishnan, Dr. P. Thirumalai Parthipan
Program on Supply Chain Management in R&D Oorganizations for CoSPs & SPOs	June 17–19, 2013 Ghaziabad	Mr. K.P.S. Ganapathy
Course on Quantitative Research Techniques and Tools for Engineering and Researchers	June 10–14, 2013 Tiruchirappalli	Mr. A. Sivasankar
International conference on Materials for Advanced Technologies	June 30 – July 5, 2013 Singapore	Mr. R. Ravikumar (SRF)
Training Programme on Basic Fire Safety with Emergency Preparedness	June 18, 2013 Madurai	Mr. G. Subramanian, Mr. K. Muniyandi
International Conference on Electron Microscopy and XXXIV Annual Meeting of the Electron Microscope Society of India	July 1–5, 2013 Kolkata	Ms. Sumana Kundu (JRF)
Workshop on Research Methodologies and Technical Writing Skills	July 5&6, 2013 Bangalore	Ms. S.S. Zance, Mr. T. Pandiarajan (JRFs); Ms. S, Jayashree, Mr. S, Natesh, Mr. R. Kamaraj (PAs)
National Conference on Recent Trends in Materials Science & Technology	July 10–12, 2013 Thiruvananthapuram	Dr. A. Manuel Stephan and Mr. M. Raja (JRF)
Induction Training Program for Scientists	July 21–30, 2013 Ghaziabad	Dr. Subhendra K. Panda, Dr. S. Vengatesan, Dr. G. Sridhar
Training Program on Multi-Disciplinary Perspective on Science, Technology & Society	July 22 – August 2, 2013 Bangalore	Dr. P. Subramanian, Dr. K. Thangavel
GARUDA, the National Grid Computing Initiative	July 25&26, 2013 Bangalore	Dr. Thirumalai Parthiban
International Conference on Frontiers in Energy Environment, Health and Materials Research	August 12&13, 203 Bhuvaneswar	Mr. M. Praveenkumar (PA); Dr. Rakesh C. Barik (QHS); Dr. Deepak Kumar Pattanayak, Dr. Subhendra K. Panda

Conferences cont...

Program	Date and venue	Participant(s)
Programme on Financial Management in Scientific Organizations	August 19–23, 2013 New Delhi	Dr. S.M. Rajendran
General Management Program	August 23 – September 6, 2013 Hyderabad	Dr. N. Kalaiselvi
Workshop on Powder, Nano & Thin Film Characteriza-tion using X-Ray Diffraction	August 29&30, 2013 Chennai	Ms. K. Andal, Ms. S. Krithika
National Symposium on Electrochemical Science & Technology	August 23&24, 2013 Bangalore	Mr. A. Sivasankar (SRF); Mr. Hosimin (JRF); Mr. Nainar Mohammed (PA)
National Conference on New Opportunities and Challenges in Microbial Research	September 5&6, 2013 Tiruchirappalli	Mr. V. Raju, Mr .S. Manikandan (PA); Ms. A. Priyadharshini (PA)
First National Conference on Computers, Communication and Applications	September 11, 2013 Karaikudi	Mr. P. Muthukumar
2nd TAPSUN Conference: Advances in Futuristic Solar Energy Materials & Technologies	September 13&14, 2013 Chennai	Er. S. Ambalavanan, Dr. D. Velayutham, Dr. I. Arulraj, Dr. M. Selvaraj, Dr. D. Jeyakumar, Er. R. Meenakshisundaram, Dr. S. Gopukumar, Dr. A. Sivashanmugam, Ms. P. Subalakshmi, Dr. M. Anbukulandainathan, Dr. M. Raju, Dr. N. Kalaiselvi, Er. M. Ramakrishnan, Dr. M.V. Ananth, Dr. S. Dheenadhayalan, Dr. P. Periasamy, Dr. Sundar Mayavan, Dr. V. Suryanarayanan, Dr. S. Ravichandran, Dr. J. Davidson, Dr. A.M. Stephen, Dr. P. Ragupathy, Dr. A.S. Prakash, Dr. K. Ramesh, Dr. M. Ganesan, Dr. C. Sivakumar, Dr. M.V.T. Dhananjeeyan, Dr. M. Jeyakumar, Mr. S.P. Karthikeyan, Dr. R. Thirunakaran, Dr. S. Vincent, Mr. S. Arul Mani; Mr. R. Ravikumar, Mr. B. Venkataramani Reddy, Ms. K.S. Anuradha (SRFs); Ms. S. Vijayalakshmi, Mr. T.K. Bijoy (JRFs); Mr. R. Karthik, Mr. G. Anantharaj, Ms. P. Meenakshi, Ms. P. Sarojini Jeeva, Mr. Mitin Kumar, Mr. V. Sannasi, Ms. V. Manju, Mr. P. Remith, Mr. V. Selvamani, Mr. R. Venkat Karthick, Mr. R. Devandra Kumar, Mr. M. Raja, Mr. S. Suresh, Mr. Y. Munniah, Mr. P. Gurunathan, Mr. K. Guruprakash, Mr. Pedda Mashaniah Ette, Ms. K. Hemalatha, Mr. Leeban Roy, Mr. Bosu Babu zasari, Ms. S. Thanalakshmi Mr. J. Karthikeyan (PAs)

Conferences cont...

Program	Date and venue	Participant(s)
Capacity Building Program for Sr. COAs/COAs/AOs	September 16–20, 2013 Ghaziabad	Mr. C. Christu Raj
National Conference on Chemosensor	September 19&20, 2013 Tituchirappalli	Mr. B. Meenakshisundaram (PA)
International Conference on Advanced Polymeric Materials	October 11–13, 2013 Kottayam	Dr. S. Venkatesan
Theme Meeting on Stainless Steels for Power Sector	October 20&21, 2013 Kalpakkam	Dr. Sundar Mayavan
Sample Preparation Workshop	October 30, 2013 Coimbatore	Mr. A. Sivasankar, Ms. A. Priyadharshini (JRF); Mr. S. Manikandan, Mr. C. Karthikeyan (PAs)
New Catalysts for Removal of Nitrate from Ground Water for Agricultural Purpose (India-France Technology Summit & Technology Platform)	October 23&24, 2013 New Delhi	Dr. S. Vasudevan
5th Asian Conference on Colloid and Interface Science	November 20–23, 2013 Darjeeling	Mr. M. Sankarra Rao (JRF)
International Conference on Directions in Materials Science	November 30 – December 1, 2013 Bangalore	Dr. S. Umadevi
51st National Metallurgists Day & 67th Annual Technical Meeting of the Indian Institute of Metals	Varanasi	Mr. B. Meenakshisundaram (PA)
International Symposium on Legacy of Nitric oxide Discovery: Impact on Disease Biology	November 5, 2013 Thiruvananthapuram	Ms. V.C. Soorya (JRF); Ms. S. Sundari (PA); S. Priya (SRF); Dr. Sheela Berchmans

Conferences cont...

Program	Date and venue	Participant(s)
Training Programme on Science & Technology for Rural Societies	November 18–29, 2013 Mussoorie	Dr. V.V. Giridhar, Mr. R. Rajasekar
Program on Science Administration and Research Management	November 11–22, 2013 Hyderabad	Dr. N. Meyyappan
Skill Development Program in Finance Accounting	November 18–29, 2013 Ghaziabad	Mr. A. Deenadayalan, Mr. M. Esakimuthu
Training Program on Powder Metallurgy	November 18–21, 2013 Hyderabad	Mr. V. Krishna Kumar (PA)
Workshop on Cleaner Technologies for Water and Wastewater	November 12&13, 2013 Tiruchirappalli	Dr. S. Vasudevan
International Conference on Magnetic Materials and Applications	December 5–7, 2013 Guwahati	Mr. S. Selva Chandrasekaran (PA)
International Conference on Emerging Trends in Chemical Sciences	December 5–7, 2013 Vellore	Ms. R. Mohini (RI)
IUMRS-ICA International Conference 2013	December 16–20, Mr. P. Remith, Mr .S. Santhosh, Ms. G. Krithika (Research scholars); Mr. J. Karthikeyan (RI)	December 16–20, Mr. P. Remith, Mr .S. Santhosh, Ms. G. Krithika (Research scholars); Mr. J. Karthikeyan (RI)
India-Japan Workshop on Biomolecular Electronics & Organic Nanotechnology for Environment Preservation	December 13–15, 2013, New Delhi	Dr. V. Ganesh; Mr. A. Muthurasu, Mr. E.T. Devakumar (PAs)
National Conference on Challengers in Biomaterials Research	December 23&24, 2013 Vellore	Dr. B. Subramanian, Dr. S. Palanichamy, Dr. Deepak Kumar Pattanayak; Dr. B. Subbiah Alwarappan (QHS); Dr. A.K. Nandakumar (SRA); Ms. Anusha Thampi, Mr. Raju Thota, Mr. E.T. Devakumar (JRFs); Ms. Archana Rajendran, Mr. S. Thangarajan, Ms. Nishali Sam (PAs); Mr. S. Arulmani (RI)

Conferences cont...

Program	Date and venue	Participant(s)
International Conference on Trends and Challenges in Concrete Structures	December 19–21, Mr. K. Saravanan	December 19–21, Mr. K. Saravanan
National Level Workshop on Antimicrobial Evaluation of Medical Products	December 12&13, 2013 Coimbatore	Dr. M. Anbukulandainathan; Mr. S. Karuppasamy (PA)
Programme on Hydrogen Energy and Advanced Materials	December 12, 2013 Thiruvananthapuram	Ms. S.S. Zance, Ms. S. Jayashree, Mr. T. Pandiarajan (JRFs)
Training Program on Linux, MySQL, Koha and CSIR Virtual Union Catalogue under CSIR Trend Modules	December 2–13, 2013 New Delhi	Mr .P. Muthukumar
Third International Science Congress	December 8&9, 2013 Coimbatore	Dr. S. Vasudevan
National Ground Water Conference on Problems, Challenges and Management of Groundwater in Agriculture	December 9–11, 2013 Coimbatore	Dr. S. Vasudevan
International Conference on Advances in Energy Research	December 10–12, 2013 Mumbai	Dr. Santhosh Kumar D. Bhatt
National Conference on Challenges in Biomaterials Research	December 23&24, 2013 Vellore	Mr. B. Kalyanasundar, S. Arulmani, C. Sivakumar
International Conference on Powder Metallurgy and Particulate Materials	January 23–25, 2014 Chennai	Dr. Deepak Kumar Pattanayak, Dr. Rakesh Barik; Ms. R. Archana (PA); Mr. P. Karthick (BTech)
National Workshop on Conducting Innovative Corrosion Control Research	January 27–31, 2014 Coimbatore	Mr. C. Karthikeyan, S. Hosimin (JRFs)
National Workshop on Open Source Software for Academic, Special and Public Libraries	January 23&24, 2014 Karakudi	Mr. P. Muthukumar, Mr. P. Murugiah
International Conference on Mathematical Computation and Modelling	January 6, 2014 Madurai	Dr. D. Sherwood

Conferences cont...

Program	Date and venue	Participant(s)
International Conference on Non-conventional Energy	January 16&17, 2014 Kalyani	Dr. S. Vasudevan
Training Program on Free LabView Hands-on Session: Explore, Evaluate and Experience NI LabView	February 4, 2014 Madurai	Mr. S. Karthikeyan (PA)
International Conference on Structural Integrity	February 4–7, 2014 Kalpakkam	Ms. R. Vedalakshmi; Ms. G. Mangaiyarkarasi, Mr. SP. Karthik, Mr. V. Maruthupandian (PAs)
Training Program on Toxicity, Safety, Biocompatibility Evaluation of Materials, Medical Devices and Combination Products	February 17–19, 2014 Thiruvananthapuram	Ms. Anusha Thampi (SRF); Ms. R. Archana (PA)
International Workshop on Coating and Surfaces for Biomedical Engineering	February 16–19, Mr. S. Thangarajan (PA)	February 16–19, Mr. S. Thangarajan (PA)
National Workshop on Impact of Information Technology on Scientometric Studies	February 17. 2014 Tiruchirappalli	Mr. S. Gunasekaran
National Program for Training of Scientists and Technologists Working in Government Sector on Soft Computing Techniques for Optimization	February 17–21, 2014 Gwalior	Er. Srinivasan Perumal
Second International Conference on Advanced Functional Materials	February 19–21, 2014 Thiruvananthapuram	Dr. Vijayamohanan K. Pillai, Dr. B. Subramanian, Dr. M. Anbukulandainathan, Dr. Subhendu K. Panda, Dr. Sreeja Kumari; Dr. T.N. Narayanan (QHS); Ms. B. Sujatha (Research scholar); Dr. A.K. Nandakumar (SRA); Ms. Anusha Thampi (SRF); Mr. S. Thangarajan, Ms. Vinuta Devi (PAs)
International Corrosion Prevention Symposium for Research Scholars	February 20&21, 2014 Mumbai	Mr. B. Meenakshisundaram, Mr. P. Feroz Khan (PAs)
11th International Discussion Meet on Electrochemistry and its Applications	February 20–25, 2014 Amirtsar	Mr. S. Hosiman, Mr. A. Sivasankar (JRFs)

Conferences cont...

Program	Date and venue	Participant(s)
International Workshop on Frontier Areas in Chemical Technologies	February 21–22, 2014 Karakudi	Dr. Subrata Kundu, Dr. C. Sivakumar; Ms. Aphouet Aurelie Koffi (Research scholar); Mr. U. Nithiyanantham, Mr. Ede Sivssankara Rao (PAs)
16th CRSI National Symposium in Chemistry	February 7–9, 2014 Mumbai	Mr. M. Kaleesh Kumar; Dr. Meditex International Conference on Current Trends in Medical Textiles Research
National Level Workshop on Antimicrobial Evaluation of Medical Products	March 1, 2014 Coimbatore	Dr. M. Anbukulandainathan; Mr. S. Karuppusamy (PA)
International Conference on Nano Science & Technology	March 3–5, 2014 Mohali	Dr. C. Sivakumar, Dr. D. Vasudevan; Mr. S. Anandha Kumar, Ms. A. Ananthi, Mr. P. Esakki Karthik, Ms. P. Sivasakthi, Mr. S. Arulmani, Ms. Sumana Kundu, Ms. Padia Rajathi (JRFs); Mr. R. Rajaram, Mr. K. Silambarasan (PAs)
International Conference on Advanced Technologies for Management of Ballast Water and Biofouling	March 4–7, 2014 Chennai	Dr. S. Palanichamy, Mr. V. Raju; Mr. K. Muthukumar, Ms. Nishali Sam (PAs)
National Conference on Nanophotonics	March 6&7, 2014 Thiruchirappalli	Dr. Subrata Kundu; Mr. U. Nithiyanantham (RI); Mr. Ede Sivasankara Rao (JRF)
National Conference on Recent Advances in Nanomaterials for Sensor Applications	March 6&7, 2014 Karaikudi	Dr. M. Paramasivam; Dr. S. Umadevi (DST Woman Scientist); Ms. B. Padmavathy (BTech)
National Conference on Indian Herbal Drugs	March 14&15, 2014 Thanjavur	Dr. SM. Rajendran, Dr. K. Radhakrishnan
Training Course on Introduction to COMSOL Multiphysics and COMSOL Multiphysics Advanced Features	March 26&27, 2014 Chennai	Dr. R. Vedalakshmi
Workshop on Computational Nanoscience	March 30–April 5, 2014 Budh Nagar	Mr. J. Karthikeyan (PA)
Workshop on Scientific Mining Policy and Critical Minerals in Kerala	March 28, 2014 Thiruvananthapuram	Dr. L. John Berchmans
Recent Advances in Water and Wastewater Treatment	March 21&22, 2014 Gandhigram	Dr. S. Vasudevan

STS-006

CHARACTERIZATION AND MEASUREMENT LABORATORY

Characterization and Measurement laboratory is a central analytical facility that provides specialized analytical services to the institute as well as to other academic institutions and industrial organizations. Analytical instruments like thermogravimetric analyzer, elemental analyzer, liquid chromatograp and atomic absorption spectrometer are housed in this laboratory.

Materials for advanced batteries, fuel cells, hydrogen production, concrete samples, functional materials, solar cells materials and polymers can be analyzed using TGA/DTA. The AAS instrument is used to analyze trace elements in seawater, drinking water, in pollution control, plating solutions, battery electrolytes, thermal products and corrosion products. With HPLC/GPC instrument, analysis of synthetic organic chemicals and molecular weight determinations of conducting polymers, polymers and various resins used in paint formulations and industrial effluents for pollution control can be carried out. The CHNS analyzer is used for the determination of percentage of composition of carbon, hydrogen, nitrogen and sulphur in samples like organic compounds, polymers, battery materials, soils, plant extracts, tannery wastes, thermal products, etc.

STS-008

COMPUTER & NETWORKING UNIT

Information and communication technology (ICT) plays an important role in the promotion of science and technology. All the modern communication channels employ ICT infrastructure to store, retrieve, manipulate, transmit and receive information. CSIR is already on the line of digitizing mode through the Enterprise Transformation Project. Hence, the mandate of CNU is to take forward the Green Initiate launched by CSIR and to advocate the use of ICT in all the activities of the divisions/ sections. This is achieved by the IT infrastructure governed by CNU. The IT infrastructure governance includes management of Data Centre, Core Switch, Firewall and Network Services. The Data Centre houses high-end storage device SAN for data redundancy and disaster recovery and high-end servers for ERP, Website, Domain Name System (DNS), Intranet, Libsys and other web enabled services. The Local Area Network (LAN) of CSIR-CECRI connects all the divisions/ sections, guest house, dispensary and BTech hostels through OFC. CNU also provides Internet and Intranet services. The Internet service is powered by 2 ISPs viz.,

National Knowledge Network (NKN) of National Informatics Centre (NIC) and BSNL with fall back option to provide uninterrupted service.

Network services

CNU provides round the clock network service to all the sections/ divisions of the Institute. The Local Area Network (LAN) of CSIR-CECRI was restructured and the connectivity was extended to more areas of the premises. New VLANs were created with optimum connections for ease of management and traffic decongestion. Provisions were also made to accommodate more network points envisaging future expansion of network.

The firewall settings were reconfigured and two more Demilitarized Zones (DMZ) were created for Name Servers, Data Centre Servers and Website. The servers were configured to work under DMZ to provide additional layer of security.

Facility creation

A new training-cum-facilitation centre for ERP operations was established in addition to the existing training centre already in operation. It was inaugurated by the DG, CSIR Prof. Samir K. Brahmachari on 27th July, 2013. CSIR-CECRI is the only CSIR laboratory to have two exclusive training centres for ERP training and ICT operations. The training centres facilitate hands-on training to the staff on application of ERP in day-today office activities and data entry operations. They also act as a helpdesk to guide ERP users in solving their issues and also extend support for scanning and printing of ERP documents.

Data centre management

New servers were deployed. Secondary name server for our domain/ sub domains (for website, recruitments, etc.) was installed for load balancing and fault tolerance. Critical databases, applications and other data were periodically backed up to SAN using schedulers. Proper functioning of servers housed at the Data Centre is ensured through an online monitoring tool.

Software development/testing/implementation/ maintenance

Software for admission to BTech course under Other State Quota for the year 2013-14: The software developed by CNU invites applications from candidates online and draws rank list category-wise in the order of the criteria laid down by the admission committee. This software was deployed successfully for admission to candidates for the year 2013–14 under other state quota.

Software for admission to B.Tech Course under Lapsed Seats for the year 2013-14: The software developed for BTech admission under other state quota was customized and deployed for admission of candidates to the BTech course under lapsed seats for the year 2013-14.

Portal for recruitment of scientists and technical staff: A separate portal for recruitment of Scientists was developed. This portal facilitates online submission of electronic application form and preparation of synopsis based on the eligibility criteria for administrative screening. As the applications are processed electronically, the human errors in data processing are eliminated and the application scrutiny is made easy and fast. This portal was deployed for recruitment of Scientists at CSIR-CECRI and CSIR HQ, New Delhi and for recruitment of Technical Officers/ Assistants at CSIR HQ.

ERP implementation

Various modules of the CSIR Enterprise Transformation Project were tested extensively before implementation. The modules that passed the test criteria were successfully implemented. Exclusive training sessions were conducted for the staff at the ERP Training Centre and additional manpower were also engaged for the timely completion of the data entry operations and uploading backlog data and documents.

Biometric attendance system

Physical Access Control System was installed and inaugurated by Dr. Suresh Das, Director, CSIR-NIIST, Trivandrum. It facilities automatic recording of entry and exit details of the staff. Biometric Attendance System is fully functional and maintained by CNU.

Web services

CSIR-CECRI website which is hosted on our server located at the Data Centre take to the masses the research activities and achievements of CSIR-CECRI. The futuristic Intranet services are aimed at providing a reliable fast communication with less manpower utilization which is a step towards e-office. CSIR-CECRI mail service powered by National Informatics Centre (NIC) is an important service offered by CNU. The mail service provides unlimited mail quota to the users, bulk and group mailing facility, easy address book import/ export. A new SMS feature has also been introduced which facilitates sending SMS from the mail account to any mobile number for official communication.

R&D support services

(i) Application of Back Propagation Neural Network (MATLAB) for predicting the service life of concrete with different cover thickness (GAP 20/10; Department of Atomic Energy, BRNS Secretariat, Mumbai. (ii) Data analysis and assessment of the different radial gate components for their suitability and structural integrity at Sardar Sarovar Project (SSP 20/10: Sardar Sarovar Nigam Limited, Vadodara).

Other support services

To put on show important events and announcements of CECRI in the plasma display system. Operation of LCD projection systems for meetings. Multi-party video conferencing facility to connect people in different locations to interact online for project meetings, review meetings, presentations, scientific discussions and assessment interviews. Servicing of computers, printers, scanners and other accessories. Maintenance of UPS systems.

Training offered

Imparted special training to the staff on various ERP modules before the modules go live. Apprenticeship trainees in PASS A trade were trained in computer hardware servicing, OS and other software installations and fixing simple network issues. They were also taught to use MS-Office.

STS-010

COA'S OFFICE

Routine administration related work and monitoring general housekeeping activities. Preparation of agenda/proceedings of three meetings of the Management Council. Convening Administrative Collegium meetings every month, followed by drafting the proceedings and follow-up action.

STS-013

WORKS & GENERAL SECTION

All official transport requirements were arranged in time. Horticulture, housekeeping, manpower, security, sweeping and cleaning contracts were monitored. Paper work relating to civil and electrical works of the Institute were carried out. Appeal for tariff change in respect of 24 EB service connections were made to the Electricity Ombudsman. Accordingly, action for effecting tariff change for a few service connections are under process. Dispatch of all official communications were done with due diligence. CSIR Foundation Day celebrations were conducted.

STS-026

GUEST HOUSE

Rooms were maintained with utmost care. Accommodations were arranged for CSIR-CECRI 56th and 57th Research Council members, Management Committee chairman, DST-PAC members, foreign visitors, inspecting officers of CSIR-JRF Examination, and state officials apart from other guests.

STS-0020

HORTICULTURE

CSIR-CECRI, located in a green ambience, has a vast area occupied with diversified plants. During 2014-15, agro forestry / social forestry plantation with 900 seedling of economically important plants, sponsored by the Tamil Nadu Forest Department, was carried out. These kinds of plants purely depend on rain water and, once in a while, water for their survival was provided.

To augment oxygen generation, a bamboo garden (Eco-park) is being maintained in our campus. Bamboo belongs to the fast growing grass family and reaches maturity quickly, in about four years. Bamboo produces 5 times more carbon and 35% more oxygen when compared with trees of other kind. Bamboo naturally absorbs 2/3 more carbon dioxide and releases 2/3 more oxygen than any other plant.

Plantation stock for Agro forestry plantotion - Western colony.

Agro forestry plontation in Western colony.

Sandal wood plants in waste lond area (2 years old).

Bamboo plantation - Eco park.

Every year, Gandhi Jayanthi is celebrated with patriotic and social fervour in our Institute. On this auspicious occasion, this year also, staff members and scholars took part in social service programmes viz., new plantation, cleaning of common area on both sides of the National Highway road in front of our campus and cleaning the rainwater canal. The plantations are being taken proper care by this section and flowering process has initiated in many of those plants.

The effluent treated water is being used effectively in waste land by planting of fruit yielding crops like Cashew, Mango and Jack. The horticulture section also collaborates with other service sections, as and when required, eg. for electricity line clearance, bush cleaning along the road side, water tank area, residential area and office premises.

In a nutshell, the horticulture section is responsible for maintenance and creation of greenery in the campus.

Gandhi Jayanthi Celebrations.

STS-022

STUDENTS' ACADEMIC COMMITTEE AND AcSIR

PhD theses submitted

1. Mr. C. Jeyabharathi (April 4, 2013)
2. Mr. R. Firoz Babu (August 19, 2013)
3. Mr. M. Rajasekaran (September 24, 2013)
4. Mr. R. Senthilkumar (September 24, 2013)

Total PhD scholar strength : 76
University scholars : 22
AcSIR scholars : 21

Courses for AcSIR students

i) Research Methodology
ii) Basic Mathematics and Numerical Methods
iii) Advanced Electrochemistry
iv) Advanced Materials Characterization Techniques
v) Electrochemical Power Sources
vi) Corrosion Science

PhD synopses submitted

Name	Title of research work	Date	Guide
S. Priya CSIR-SRF	Functionalized surfaces and materials for sensing biomolecules and nitric oxide release	June 6, 2013	Dr. Sheela Berchmans
D. Bhuvaneswari CSIR-SRF	Investigation of $LiMO_2$ and LiM_xO_4 based cathodes for lithium batteries application	June 10, 2013	Dr. N. Kalaiselvi
N. Rajasekaran CSIR-SRF	Giant magnetoresistance of Co-Cu materials deposited using electrochemical method	July 26, 2013	Dr. S. Mohan
T. Vijayakumar Research Scholar	Electrodeposition of Ni-based alloys as electrode materials for hydrogen evolution reaction	September 20, 2013	Dr. S. Mohan
P. Manikandan CSIR-SRF	Investigation on advanced cathode materials for lithium-ion batteries	November 11, 2013	Dr. P. Periasamy
T. Sri Devi Kumari CSIR-SRF	Lithium-insertion anode materials based on carbon and silicon	December 18, 2013	Dr. D. Jeyakumar
S. Anandhakumar CSIR-SRF	Hybrid electrochmeical sensors for environmental monitoring	December 26, 2013	Dr. J. Mathiyarasu

PhD Degree Awarded

Name	Title of research work	Guide	Date of award
R. Karthikeyan	Development of mediatorless microbial fuel cells using Acetobacter aceti and Gluconabacter roseus as whole cell electrogenic biocatalusts	Dr. Sheela Berchmans	November 25, 2013
K. Kamaraj	Electrodeposited coatings for corrosion protection	Dr. S. Sathiyanarayanan	November 25, 2013
C. Jeyabharathi	Studies on selective catalysis in application to electrochemical systems	Dr. K.L.N. Phani	November 25, 2013
V. Karpagam	Corrosion protection of ferrous metals by electro-polymerised coatings	Dr. S. Sathiyanarayanan	November 25, 2013
S. Harish	Exploration of synthetic routes for nano-structured materials: their applications in catalysis	Dr. James Joseph	November 25, 2013
A. Kumaravel	Studies on electroanalysis of pesticides	Dr. M. Chandrasekaran	November 25, 2013
Gangulibabu	Lithium intercalating cathodes for rechargeable lithium batteries and electrolytes for lithium sulphur system	Dr. N. Kalaiselvi	November 25, 2013
P. Arunkumar	Studies on synthetic strategies of phosphor materials based on molecular precursors	Dr. D. Jeyakumar	January 8, 2014
N. Rajasekaran	Giant magnetoresistance of Co-Cu materials deposited using electrochemical method	Dr. S. Mohan	January 16, 2014
R. Senthilkumar	Studies on the electrochemical synthesis of metal organic frameworks and its multifarious applications	Dr. M. Anbukulandainathan	February 6, 2014
Firoz Babu	Studies on polypyrrole and its composite coatings for functional fabrics: synthesis, characterization and applications	Dr. M. Anbukulandainathan	February 7, 2014

IMPORTANT EVENTS

- May 10, 2013. National Technology Day. Mr. R. Prakash, Head, New Technologies & IP, Mahindra Reva Limited, Bangalore delivered a lecture on EV trends and the poised battery challenges.

- May 21, 2013. Anti-Terrorism Day. CECRI staff took pledge on control of terrorism.

- July 25, 2013. CSIR-CECRI Foundation Day. Dr. P.R. Vasudeva Rao, Director, Indira Gandhi Centre for Atomic Research, Kalpakkam delivered the Foundation Day Lecture on Chemistry for fast reactors and associated fuel cycle. Professor K.T. Jacob, Chairman, Research Council, CECRI presided over the function.

Dr. P.R. Vasudeva Rao delivering the 2013 CECRI Foundotion Day Lecture.

- July 27, 2913. Unveiling of a bust of Dr. RM. Alagappa Chettiar and opening of the Ramanujan Block of Kendriya Vidyalaya. Shri P. Chidambaram, Honorable Union Minister for Finance unveiled a bust of Dr. RM. Alagappa Chettiar at CECRI and opened the Ramanujan Block at the Kendriya Vidyalaya. Professor Samir K. Brahmachari, DG-CSIR was present on this occasion.

- August 15, 2013. Independence Day. Dr. Vijayamohanan K. Pillair, Director, CSIR-CECRI hoisted the national flag.

- September 26, 2013. CSIR Foundation Day. Dr. Ram P. Bajpai, Chancellor, Vel Tech Technical University, Chennai and Former Director, CSIR-Central Scientific Instruments Organization, Chandigarh delivered the CSIR Foundation Day Lecture on Future biomolecular and nano devices.

- September 27, 2013. CSIR-CECRI Open Day. The institute was opened to the general

Finance Minister P. Chidambaram unveiling a bust of Dr. RM. Alagappa Chettiar in presence of DG, CSIR.

Finance Minister P. Chidambaram apening the Ramanujan Black af Kendriya Vidyalaya as the DG-SIR and Director, CECRI look on.

public, exhibiting its scientific achievements and to disseminate science. Between 10 am and 4 pm, thousands of school and college students as well as the public witnessed a smorgasbord of technologies, many with working models, emanating from CECRI.

- September 2013. Hindi Month. As a part of Hindi language development program, month-long events were organized, including a workshop on Hindi grammar (on 28.09.2013). Shri Kamaljeeth Singh, Instructor, Hindi Teaching Scheme, Madurai taught the basics of Hindi grammar. The valedictory function was held on 03.10.2013. Dr. KL. Muthu Ramu, Principal, Shanmuganathan Engineering College, Thirumayam was the chief guest.

- October 28 to November 1, 2013. Vigilance Awareness Week. CECRI staff observed the Vigilance Awareness Week as per instructions of the Central Vigilance Commission.

- December 9, 2013. Nobel Day. Invited speakers spoke on the significance of each of the Nobel Prizes.

Dr. Ram P. Bojpai delivering the 71st CSIR Foundotion Day Lecture.

A part of the public on the 2013 CSIR Open Day.

Hindi Month celebrations 2013.

- January 26, 2014. Republic Day. Dr. Vijayamohanan K. Pillair, Director, CSIR-CECRI hoisted the national flag.
- January 30, 2014. Martyrdom Day. CECRI staff observed two minutes of silence to pay homage in memory of those who gave their lives in the struggle for India's freedom.
- February 28, 2014. National Science Day. Professor P. Ganguly, Emeritus Scientist, National Chemical Laboratory, Pune delivered the National Science Day lecture on Science: Fermenting Ideas.
- March 1, 2014. Dr. Sourav Pal, Director, National Chemical Laboratory, Pune gave a lecture on Chemistry in future: Need for an integrative approach.
- March 4, 2014. National Safety Day. The day was celebrated as part of safety observance in the working place.

Professor P. Ganguly delivering the National Science Day Lecture.

INVITED LECTURES

Date	Speaker	Title of the lecture
April 12, 2013	Dr. R. Pothiraja Institute for Electrical Engineering and Plasma Technology, Ruhr -University Bochum, Germany	Thin film coatings for various applications
April 22, 2013	Dr. S. Devaraj Department of Mechanical Engineering, National University of Singapore, Singapore	Nano-structured electrode materials for advanced energy storage devices
April 25, 2013	Dr. Devasish Chowdhury Institute of Advanced Study in Science and Technology, Guwahati	Novel nano-materials with useful properties
May 3, 2013	Dr. Murugananthan Oak Ridge National Laboratory, Oak Ridge, USA	Rational design of functional materials using soft matter self-assembly as a tool
May 10, 2013	Shri. Jayesh K.Unnikrishnan CSIR Headquarters, New Delhi	Contract labor and contract research
May 10, 2013	Shri. R. Prakash Mahindra Reva Ltd, Bangalore	National Technology Day lecture: EV trends and battery challenges
May 15, 2013	Shri. Subbiah Arunachalam Centre for Internet and Society & National Mission on Libraries, New Delhi	Publishing your research: Maximizing advantage and minimizing costs
May 27, 2013	Dr. Sankara Papavinasam Corrosion Management Consulting Inc, Ottawa, Canada	Advances in corrosion control in oil and gas production systems
June 12, 2013	Prof. P. Murugavel Indian Institute of Technology Bombay, Mumbai	Design and synthesis of porous solids
June 18, 2013	Prof. Soji Kaneko Shizuoka University, Japan & SPD Laboratory, Japan	Spray pyrolysis deposition method and its application to large area dye sensitized solar cell fabrication
June 27, 2013	Dr. V.P. Sharma & Dr.Rakesh Kumar Indian Institute of Toxicology Research, Lucknow	International standard ISO/IEC 17025:2005, General requirement for the competence of testing: awareness and strategies

Date	Speaker	Title of the lecture
July 22, 2013	Dr. K.E. Perumal All India Council for Technical Education, Chennai	Analysis of recent major fire and corrosion failure in big oil refinery
July 25, 2013	Dr. P.R. Vasudeva Rao Indira Gandhi Centre for Atomic Research, Kalpakkam	CSIR-CECRI Foundation Day lecture: Chemistry for fast reactors and associated fuel cycle
July 26, 2013	Dr. Mrinal R. Pai Bhabha Atomic Research Centre, Trombay	Photocatalytic hydrogen generation: Fundamentals, challenges and factors affecting hydrogen yield
August 2, 2013	Dr.Kaliaperumal Selvaraj of Nano & Computational Materials Lab, Catalys is Division, CSIR-NCL, Pune.	On "Exploiting Supramolecular Self assembly for functional bio - inorganic nanohybird materials".
September 5, 2013	Prof. P. Natarajan University of Madras, Taramani, Chennai	Photo-processes of coordi nation compounds and some organic dyes in solution and in porous materials
September 12, 2013	Dr. Chinmoy Bhattacharya Bengal Engineering and Science University, Shibpur	Applications of scanning electrochemical microscopy in rapid screening of suitable doping elements into the semiconductor matrix for efficient photo electrochemical solar cells
September 26, 2013	Dr. Ram P. Bajpai Vel Tech Technical University, Chennai	CSIR Foundation Day lec ture: Future bio and nano devices
October 22, 2013	Mr. Jia De Peng National Taiwan University, Taipei, Taiwan	Design and characterization of functional TiO_2 nanostructures for DSSC applications
November 12, 2013	Shri. Mochammad Syaiful Anwar	Lightweight conductive cementitious morton anode for impressed current cathodic protection of steel reinforced concrete application
November 20, 2013	Dr. Philip Earis & Dr. Rajesh Parishwad Royal Society of Chemistry, Mumbai	Royal Society of Chemistry (India) and publishing in high impact journals

Date	Speaker	Title of the lecture
January 1, 2014	Dr. Sujoy Gosh University of Southern Illinois, USA	Synthesis, application and electronic transport properties of graphene and other 2D materials
February 28, 2014	Prof. P. Ganguly National Chemical Laboratory, Pune	The National Science Day lecture: Science: Fermenting Ide as
March 1, 2014	Dr. Sourav Pal National Chemical Laboratory, Pune	Chemistry in future: Need for integrative approach
March 11, 2014	Prof. Pramanik Indian Institute of Technology, Kharagpur	Prevention of cancer – proven methodology
March 12, 2014	Dr. Tulsi Mukherjee Former Director of Bhabha Atomic Research Centre, Tromaby	Energy scenario in India : Role of nuclear energy and its societal applications
March 19, 2014	Prof.B.V.R.Chowdari National University of Singapore	Lithium ion batteries - Materials aspects and perspectives

Dr. Sourav Pal (left) being felicitated by Dr. Vijayamahonan Pillai; and (right) giving away prizes for the best electran microscopic images.

LECTURES DELIVERED

Shri. S. Ambalavanan	Lead-acid battery for multifarious applications	Monthly colloquium series, CECRI, October 20, 2013.
Dr. S. Angappan	A walk into Raman's life	National Science Day celbrations, CECRI, February 28, 2013.
Dr. Deepak Kumar Pattanayak	Development of bioactive Ti metal by surface chemical treatments: Concept to clinic	Monthly colloquium series, CECRI, August 7, 2013.
Dr. V. Ganesh	Nanotechnology-based electrochemical platforms for (bio) sensing and catalytic applications	National Conference NANOSE-2014, Alagappa University, Karaikudi, March 7, 2013.
	Electrochemical platforms for bio-sensing and catalytic applications – nano at play	IJWBME-2013 International Conference, Delhi Technological University, New Delhi, December 12–16, 2013.
Dr. S. Kundu	Structural and electrochemical evaluation of fuel cell catalysts	Applictions of Nano-Structured Materials - Energy Domain, Anna University, Regional Centre, Coimbatore, March 6, 2014.
Dr. N. Lakshminarasimhan	Photofunctional materials	M. Kumarasamy College of Engineering, Karur, November 08, 2013.
	Structure-property relations in photofunctional materials	National Conference on Recent Trends in Materials Science, M. Kumarasamy College of Engineering, Karur, November 7, 2013.
	Solar energy conversion materials	Refresher Course in Physics, Bharathiyar University, Coimbatore, September 28, 2013.
Dr. P. Murugan	Raman effect	National Science Day celebrations, CECRI, February 28, 2013.
Dr. Palani Natarajan	Design and synthesis of awkwardly shaped molecules and their applications to electroluminescence and electrochemiluminescence	CECRI, November 6, 2013.

Lectures delivered...

Dr. N. Palaniswamy	Potential measurements in cathodic protection	CECRI, April 3, 2013.
Dr. T. Prem Kumar	Lithium batteries	Workshop on Alternative Energy in Perspective of Nanotechnology (Quanta '13), Anna University, Chennai, April 13, 2013.
	English for technical paper writing	Workshop on Technical English, National Institute of Technology, Tiruchirapalli, May 25, 2013.
	Nuts and bolts of thesis writing	National workshop on Thesis Writing, Bharathidasan University, Tiruchirapalli, January 29, 2014.
	Writing for journals	Workshop on Quality Research Report Writing exclusively for research guides of Bharathidasan University, Tiruchirapalli, February 27, 2014.
Dr. P, Ragupathy	Multifunctional materials for electrochemical energy storage and conversion devices	National Seminar on Electrochemical Energy Storage Devices for Renewable Energy Systems, Mount Zion College of Engineering and Technology, Pudukkottai, May 6, 2013.
Dr. S. Ravichandran		National Workshop on Current Trends in Chemistry, Arul Anandar College, Karumathur, February 27&28, 2014.
Dr. Santhosh Kumar D. Bhatt	Recent advances in materials for polymer electrolyte fuel cells	Indo-US Workshop on Engineered Electrodes for Electrochemical Energy Storage, Chennai.
Dr. M. Sathish	Interfacial reactions in materials synthesis, energy storage and conversion	Monthly colloquium series, CECRI. September 19, 2013.
Dr. S. Senthil Kumar	Insights of simple electrochemical techniques used in nanomaterials synthesis: Characterization and electro-catalytic applications	TEQIP Workshop, Anna University, Tiruchirappalli, December 11, 2013.
	Electrocatalysis at metal nanoparticles and metal clusters surface	National Seminar on Catalysis and Catalyzed Reactions. Madurai Kamaraj University, Madurai, March 28, 2014.

Lectures delivered...

Dr. S. Senthil Kumar	Science, society and successful scientist	DST INSPIRE Science Camp, Mahatma Gandhi Shikhsak Prashikshan Mahavidhyalaya, Bihar, December 22–26, 2013.
	Electrochemistry at fractal interfaces	Workshop on Computational Materials Chemistry, CECRI, March 1, 2014.
	Self-assembled layers and their electrochemical significance	National Institute of Technology, Tiruchirappalli, March 10, 2014.
Dr. Sheela Berchmans	My Fulbright research	International Education Fair, SanDiego, USA, November 19, 2013.
	Bioelectrochemistry	University of Neveda, USA, November 22, 2013.
Dr. P. Sridhar	Advances in polymer electrolyte membrane fuel cell	Monthly colloquium series, CECRI, June 28, 2013.
Dr. Subbiah Alwarappan	Development and characterization of carbon-based materials for electrochemical bio-sensing applications	Monthly Colloquium series, CECRI, May 8, 2013.
	A walk through C.V. Raman's life	National Science Day celebrations, CECRI, February 28, 2014.
Dr. B. Subramanian	Bio-surface engineering by physical and chemical methods for implants	International Workshop on Coatings and Surfaces for Biomedical Engineering, Indian Institute of Technology Madras, Chennai, February 16–19, 2014.
	Thin films for health care applications	National Conference on Nanophotonics, Bharathidasan University, Tiruchirappalli, March 6&7, 2014.
Dr. Sundar Mayavan		2nd TAPSUN Conference on Advances in Futuristic Solar Energy Materials and Technologies, Chennai, 2013.

Dr B. Subramanian chairing a session at an International Workshop at IIT Madras

Dr. Sheela Berchmans delivering a lecture at the University of Nevada

Dr. T. Prem Kumar interacting with the participants during a workshop on technical writing at NIT, Tiruchirappalli

Lectures delivered...

Dr. Vijayamohanan K. Pillai		Annual Day function at KLN-CIT, Madurai, April 12, 2013.
	R.K. Barua Memorial Lecture	Guwahati University, Assam, May 17, 2013.
	Impact of molecular nanotechnology on materials research	Summer Training Program in Physics and Chemistry, Indira Gandhi Centre for Atomic Research, Kalpakkam, July 5, 2013.
	Transformation of carbon nanotubes to graphene quantum dots: Size-dependent optical and electron transfer properties	National Conference on Recent Trends in Materials Science and Technology, Indian Institute of Space Science and Technology, Thiruvananthapuram, July 12, 2013.
	Functional nano materials for electrochemical energy storage (keynote address)	International Conference on Advanced Materials, Processes and Devices, Madurai Kamaraj University, Madurai, July 15, 2013.
	The world of intelligent materials	Pondicherry University, August 23, 2013.
	Graphene quantum dots	Workshop on Advances in Chemistry, Gandhigram Rural University, Dindigul, September 6, 2013.
	Chemistry and the world of intelligent materials	Workshop on Advances in Chemistry, Gandhigram Rural University, Dindigul, September 6, 2013.
	Graphene quantum dots	Workshop on Advances in Chemistry, Alagappa University, Karaikudi, September 21, 2013.
	Electrochemical preparation of N-doped graphene quantum dots	National Conference on Frontiers in Physical, Chemical and Biological Sciences, University of Pune, Pune, October 6, 2013.
	Graphene quantum dots from carbon nanotubes: Preparation, electron transfer behavior and humidity- dependent charge trap states	Indian Institute of Technology, Guwahati, November 11, 2013.
	Chemistry and the world of multifunctional materials	AMMRC, Mahatma Gandhi University, Kottayam, November 15, 2013.

HONOURS/AWARDS/RECOGNITIONS

Dr. S. Vasudevan
Principal Scientist

Eminent Scientist Award 2013
by Indian Society for Electroanalytical Chemists.

A commemoration award marking the Golden Jubilee Year of Electrochemical Society of India.August 23, 2013.

Dr. N. Palaniswamy
Chief Scientist

Dr. Santhosh Kumar D. Bhatt
Senior Scientist

CSIR Young Scientist Award for Chemical Sciences 2013, September 26, 2013.

Outstanding Achievement Award for effective implementation of ERP.

Team CSIR-CECRI

Dr. N Kalaiselvi
Principal Scientist

MRSI Medal for 2013. February 12–14, 2014.
India's Most Inspiring Woman Scientist Award for 2014

Bharat Jothi award of the India International Friendship Society.

Dr. M. Paramasivam
Senior Principal Scientist

Dr. Subrata Kundu, Scientist. Nominated as editorial board member of three international journals: World Research Journal of Materials Science and Engineering; International Journal of Applied Physics and Nanosciences; Advances in Organic Chemistry; Chemistry, Biology and Environment Review; and Open Journal of Physical Chemistry.

Dr. S. Vasudevan, Principal Scientist. Appointed as Associate Editor of Environmental Chemistry Letters.

CECRI scientists inspected the world's largest overhead reservoir, the Tallah Tank in Kolkatta and suggested plans to protect it from the ravages of corrosion.

Dr. S. Muthukrishnan, Senior Principal Scientist, represented CSIR in the discussion with the Honorable Union Minister of State for Commerce and Industry on issues concerning the fireworks industry, including reviving the defunct Fireworks Research and Development Centre.

PUBLICATIONS 2013

Sl. No.	Publication	Impact factor 2012
1	Majumdar, D; Singha, A; Mondal, PK; Kundu, S., DNA-mediated wirelike clusters of silver nanoparticles: An ultrasensitive SERS substrate, *ACS Appl. Mater. Interfaces* **5**, 7798-7807 (2013)	**5.008**
2	Sudhesh, P; Tamilarasan, K; Arumugam, P; Berchmans, S., Nitric oxide releasing photoresponsive nanohybrids as excellent therapeutic agent for cervical cancer cell lines, *ACS Appl. Mater. Interfaces* **5**, 8263-8266 (2013)	**5.008**
3	Gill, RS; Saraf, RF; Kundu, S., Self-assembly of gold nanoparticles on poly(allylamine hydrochloride) nanofiber: a new route to fabricate "Necklace" as single electron devices, *ACS Appl. Mater. Interfaces* **5**, 9949-9956 (2013)	**5.008**
4	Umadevi, S; Feng, X; Hegmann, T., Large area self-assembly of nematic liquid-crystal-functionalized gold nanorods, *Adv. Funct. Mater.,* **23**, 1393-1403 (2013)	**9.765**
5	Romero-Aburto, R; Narayanan, TN; Nagaoka, Y; Hasumura, T; Mitcham, TM; Fukuda, T; Cox, PJ; Bouchard, RR; Maekawa, T; Kumar, DS; Torti, SV; Mani, SA; Ajayan, PM., Fluorinated graphene oxide; a new multimodal material for biological applications, *Adv. Mater.*, **25**, 5632-5637 (2013)	**14.829**
6	Maheswari S., Sridhar P., Pitchumani S., Palladium supported on partially unzipped carbon nanotube as a methanol tolerant catalyst for oxygen reduction reaction in alkaline medium, *AIP Conf. Proc.,* **1538**, 209-212 (2013)	
7	Jayakumar C., Jeseentharani V., Subba reddy Y., Anbu Kulandainathan M., Seetharamaiah Nagaraj K., Jeyaraj B., Electrochemical determination of L-dopa in the presence of ascorbic acid by gold nanoparticles functionalized 8-hydroxyquinoline modified glassy carbon electrode, *Anal. Bioanal. Electrochem.,* **5**, 193-205 (2013)	**3.659**

Sl. No.	Publication	Impact factor 2012
8	Samseya, J; Srinivasan, R; Chang, YT; Tsao, CW; Vasantha, VS., Fabrication and characterisation of high performance polypyrrole modified microarray sensor for ascorbic acid determination, *Anal. Chim. Acta* **793**, 11-18 (2013)	**4.387**
9	Kumaravel, A; Vincent, S; Chandrasekaran, M., Development of an electroanalytical sensor for gamma-hexachlorocyclohexane based on a cellulose acetate modified glassy carbon electrode, *Anal. Methods* **5**, 931-938 (2013)	**1.855**
10	Senthil Kumar S., Bard A.J., Background emission of electrogenerated chemiluminescence during oxidation of tri-n-propylamine from the dimeric 1Δg state of O_2, *Anal. Chem.*, **85**, 292-295 (2013)	**5.695**
11	Anandhakumar, S; Mathiyarasu, J; Phani, KLN., Anodic stripping voltammetric determination of cadmium using a "mercury free" indium film electrode, *Analyst* **138**, 5674-5678 (2013)	**3.969**
12	Shinde, DB; Pillai, VK., Electrochemical resolution of multiple redox events for graphene quantum dots, *Angew. Chem.-Int. Edit.*, **52**, 2482-2485 (2013)	**13.734**
13	Sethulakshmi, N; Sooraj, V; Sajeev, US; Nair, SS; Narayanan, TN; Joy, LK; Joy, PA; Ajayan, PM; Anantharaman, MR., Contact potential induced enhancement of magnetization in polyaniline coated nanomagnetic iron oxides by plasma polymerization, *Appl. Phys. Lett.*, **103**, 16 (2013)	**3.794**
14	Kalita, H; Harikrishnan, V; Shinde, DB; Pillai, VK; Aslam, M., Hysteresis and charge trapping in graphene quantum dots, *Appl. Phys. Lett.*, **102**, 143104 (2013)	**3.794**
15	Manu, R; Priya, S., Implication of electrodeposition parameters on the architecture behavior of MWCNT - incorporated metal matrix, *Appl. Surf. Sci.*, **284**, 270-277 (2013)	**2.112**
16	Kathirvel, P; Saraswathy, V; Karthik, SP; Sekar, ASS., Strength and durability properties of quaternary cement concrete made with fly ash, rice husk ash and limestone powder, *Arab. J. Sci. Eng.*, **38**, 589-598 (2013)	**0.385**
17	Sankar, A; Kumaravel, M; Rameshkumar, S; Vijayan, M., Chemical synthesis of conductive poly(methoxyaniline) in hydroxyethylidenediphosphonic acid, *Asian J. Chem.*, **25**, 3001-3004 (2013)	**0.253**

Sl. No.	Publication	Impact factor 2012
18	Malathy, V; Balasubramanian, T; Jayachandran, M., Compositional and surface morphological analysis on indium tin oxide thin films prepared by radio frequency sputtering, *Asian J. Chem.*, **25**, S279-S282(2013)	**0.253**
19	Vasudevan, S; Lakshmi, J; Kamaraj, R; Sozhan, G., A critical study on the removal of copper by an electrochemically assisted coagulation: equilibrium, kinetics, and thermodynamics, *Asia-Pac. J. Chem. Eng.*, **8**, 162-171 (2013)	**0.797**
21	Latha, N; Raj, V; Selvam, M., Effect of plating time on growth of nanocrystalline Ni-P from sulphate/glycine bath by electroless deposition method, *Bull. Mat. Sci.*, **36**, 719-727 (2013)	**0.584**
22	Nishanth, KG; Sridhar, P; Pitchumani, S; Shukla, AK., Pt-Ru decorated self-assembled TiO_2-carbon hybrid nanostructure for enhanced methanol electrooxidation, *Bull. Mat. Sci.*, **36**, 353-359 (2013)	**0.584**
23	Ganesan, P; Lakshmi, J; Sozhan, G; Vasudevan, S., Removal of manganese from water by electrocoagulation: Adsorption, kinetics and thermodynamic studies, *Can. J. Chem. Eng.*, **91**, 448-458 (2013)	**1.003**
24	Babu, KF; Subramanian, SPS; Kulandainathan, MA., Functionalisation of fabrics with conducting polymer for tuning capacitance and fabrication of supercapacitor, *Carbohydr. Polym.*, **94,** 487-495 (2013)	**3.479**
25	Takahashi, C; Pattanayak, DK; Shirai, T; Fuji, M., Application of hydrophilic ionic liquid treatment to the morphological observations of hydrated porous ceramic green bodies, *Ceram. Int.*, **39,** 1065-1073 (2013)	**1.789**
26	Muthu, KS; Lakshminarasimhan, N., Impedance spectroscopic studies on $NiFe_2O_4$ with different morphologies: Microstructure vs. dielectric properties, *Ceram. Int.*, **39,** 2309-2315 (2013)	**1.789**
27	Dharuman, N; Berchmans, LJ., Low temperature synthesis of nano-crystalline gadolinium titanate by molten salt route, *Ceram. Int.*, **39,** 8767-8771 (2013)	**1.789**
28	Sathiya, M; Ramesha, K; Rousse, G; Foix, D; Gonbeau, D; Guruprakash, K; Prakash, AS; Doublet, ML; Tarascon, JM., Li_4NiTeO_6 as a positive electrode for Li-ion batteries, *Chem. Commun.*, **49**, 11376-11378 (2013)	**6.378**

Sl. No.	Publication	Impact factor 2012
29	Subramanian, K; Suresh, S; Asokan, K., electrosynthesis of solid tetra ethyl ammonium tribromide (TEATB) in a membrane electrolyzer, *Chem. Eng. Commun.*, **200,** 1210-1219 (2013)	**1.052**
30	Annapurna, B; Meenakshi, S; Bhat, SD; Seshadri, S., Microbial extracellular polysaccharide-based membrane in polymer electrolyte fuel cells, *Chem. Eng. J.*, **231,** 373-379 (2013)	**3.473**
31	Basha, CA; Saravanathamizhan, R; Nandakumar, V; Chitra, K; Lee, CW., Copper recovery and simultaneous COD removal from copper phthalocyanine dye effluent using bipolar disc reactor, *Chem. Eng. Res. Des.*, **91,** 552-559 (2013)	**1.927**
32	Sathiya, M; Ramesha, K; Rousse, G; Foix, D; Gonbeau, D; Prakash, AS; Doublet, ML; Hemalatha, K; Tarascon, JM., High performance $Li_2Ru_{1-y}Mn_yO_3$ ($0.2 \leqslant y \leqslant 0.8$) cathode materials for rechargeable lithium-ion batteries: their understanding, *Chem. Mat.*, **25**, 1121-1131 (2013)	**8.238**
33	Jeyabharathi, C; Hodnik, N; Baldizzone, C; Meier, JC; Heggen, M; Phani, KLN; Bele, M; Zorko, M; Hocevar, S; Mayrhofer, KJJ., Time evolution of the stability and oxygen reduction reaction activity of PtCu/C nanoparticles, *ChemCatChem,* **5**, 2627-2635 (2013)	**5.181**
34	Nithya, C; Gopukumar, S., Reduced graphite oxide/nano Sn: a superior composite anode material for rechargeable lithium-Ion batteries, *ChemSusChem,* **6,** 898-904 (2013)	**7.475**
35	Boomi, P; Prabu, HG; Mathiyarasu, J., Synthesis and characterization of polyaniline/Ag-Pt nanocomposite for improved antibacterial activity, *Colloid Surf. B-Biointerfaces,* **103,** 9-14 (2013)	**3.554**
36	Krishnaraj, RN; Chandran, S; Pal, P; Berchmans, S., Screening of photosynthetic pigments for herbicidal activity with a new computational molecular approach, *Comb. Chem. High Throughput Screen,* **16,** 777-781 (2013)	**2.000**
37	Saraswathy, V; Karthick, SP., A state-of-the-art review on the durability of silica fume-blended concrete - a boon to the construction industry, *Corros. Rev.*, **31,** 123-134 (2013)	**0.500**

Sl. No.	Publication	Impact factor 2012
38	Thirurnalairajan, S; Girija, K; Ganesh, V; Mangalaraj, D; Viswanathan, C; Ponpandian, N., Novel synthesis of $LaFeO_3$ nanostructure dendrites: a systematic investigation of growth mechanism, properties, and biosensing for highly selective determination of neurotransmitter compounds, *Cryst. Growth Des.*, **13,** 291-302 (2013)	**4.689**
39	Kundu, S; Mukadam, MD; Yusuf, SM; Jayachandran, M., Formation of shape-selective magnetic cobalt oxide nanowires: environmental application in catalysis studies, *Crystengcomm,* **15,** 482-497 (2013)	**3.879**
40	Aravindan, V; Vickraman, P; Sivashanmugam, A; Thirunakaran, R; Gopukumar, S., Comparison among the performance of LiBOB, LiDFOB and LiFAP impregnated polyvinylidenefluoride-hexafluoropropylene nanocomposite membranes by phase inversion for lithium batteries, *Curr. Appl. Phys.*, **13,** 293-297 (2013)	**1.814**
41	Vasudevan, S; Lakshmi, J; Sozhan, G., Electrochemically assisted coagulation for the removal of boron from water using zinc anode, *Desalination,* **310,** 122-129 (2013)	**3.041**
42	Munaiah, Y; Dheenadayalan, S; Ragupathy, P; Pillai, VK., High performance carbon nanotube based electrodes for zinc bromine redox flow batteries, *ECS J. Solid State Sci. Technol.*, **2,** M3182-M3186 (2013)	
43	Kalidas, N; Kalaiselvi, N; Minakshi, M., Oxalic dihydrazide assisted novel combustion synthesized $Li_3V_2(PO_4)(3)$ and $LiVP_2O_7$ compounds for rechargeable Lithium batteries, *ECS Trans.,* **50,** 79-88 (2013)	
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147	Navaneetha Pandiyaraj, K; Selvarajan, V; Deshmukh, RR; Yoganand, P; Balasubramanian, S; Maruthamuthu, S., Low pressure dc glow discharge air plasma surface treatment of polyethylene (PE) film for improvement of adhesive properties, *Plasma Sci. Technol.*, **15,** 56-63 (2013)	**0.514**
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150	Pal, P; Pahari, SK; Sinhamahapatra, A; Jayachandran, M; Kiruthika, GVM; Bajaj, HC; Panda, AB., CeO2 nanowires with high aspect ratio and excellent catalytic activity for selective oxidation of styrene by molecular oxygen, *RSC Adv.*, **3,** 10837-10847 (2013)	**2.562**
151	Balamurugan, J; Thangamuthu, R; Pandurangan, A., Effective synthesis of carbon nanotubes of high purity over Cr-Ni-SBA-15 and its application in high performance dye-sensitized solar cells, *RSC Adv.*, **3,** 4321-4331 (2013)	**2.562**
152	Damien, D; Sudeep, PM; Narayanan, TN; Anantharaman, MR; Ajayan, PM; Shaijumon, MM., Fluorinated graphene based electrodes for high performance primary lithium batteries, *RSC Adv.*, **3,** 25702-25706 (2013)	**2.562**
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154	Yathindranath, V; Ganesh, V; Worden, M; Inokuchi, M; Hegmann, T., Highly crystalline iron/iron oxide nanosheets via lyotropic liquid crystal templating, *RSC Adv.*, **3,** 9210-9213 (2013)	**2.562**
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157	Krishnaraj, RN; Berchmans, S., In vitro antiplatelet activity of silver nanoparticles synthesized using the microorganism Gluconobacter roseus: an AFM-based study, *RSC Adv.*, **3,** 8953-8959 (2013)	**2.562**
158	Kumari, TSD; Jeyakumar, D; Kumar, TP., Nano silicon carbide: a new lithium-insertion anode material on the horizon, *RSC Adv.*, **3**, 15028-15034 (2013)	**2.562**
159	Kundu, S; Jayachandran, M., The self-assembling of DNA-templated Au nanoparticles into nanowires and their enhanced SERS and catalytic applications, *RSC Adv.*, **3,** 16486-16498 (2013)	**2.562**
160	Angulakshmi, N; Nahm, KS; Choi, JM; Hwang, YJ; Stephan, AM., Electrochemical properties of coconut shell flour-incorporated poly(vinylidene-hexafluoropropylene)-based electrospun membranes for lithium batteries, *Sci. Adv. Mater.*, **5,** 606-611 (2013)	**2.509**
161	Azarudeen, RS; Subha, R; Jeyakumar, D; Burkanudeen, AR., Batch separation studies for the removal of heavy metal ions using a chelating terpolymer: Synthesis, characterization and isotherm models, *Sep. Purif. Technol.*, **116,** 366-377 (2013)	**2.894**
162	Choi, JH; Maruthamuthu, S; Lee, YJ; Alshawabkeh, AN., Reduction of nitrate in Agricultural Soils by Bio-electrokinetics, *Soil. Sediment. Contam.*, **22,** 767-782 (2013)	**0.509**
163	Nithya, C; Sowmiya, T; Baskar, KV; Selvaganeshan, N; Kalaiyarasi, T; Gopukumar, S., High capacity $Sn_xSb_yCu_z$ composite anodes for lithium ion batteries, *Solid State Sci.*, **19,** 144-149 (2013)	**1.671**

Sl. No.	Publication	Impact factor 2012
164	Vikram, K; Nandi, R; Singh, RK., Low temperature Raman study of a liquid crystalline system 4-Decyloxy benzoic acid (4DBA), *Spectroc. Acta Pt. A.*, **112,** 377-383 (2013)	**1.977**
165	Kanagasabapathy, M; Bapu, GNKR; Sivan, R; Sivaramamoorthy, K; Rajkumar, SR., Galvanostatic cathodic polarization studies on anomalously co-electrodeposited $Ni_{2-18}Co_{13-97}$ solid solution nano films, *Surf. Coat. Technol.*, **232,** 188-197 (2013)	**1.941**
166	Ajit, S; Palaniappan, S; Gopukumar, S., Polyaniline binder for functionalized acetylene black: A hybrid material for supercapacitor, *Synth. Met.*, **180,** 43-48 (2013)	**2.109**
167	Srinivasan, R; Bapu, GNKR., Effect of additives on electrodeposition of nickel from acetate bath: cyclic voltammetric study, *Trans. Inst. Metal Finish.*, **91,** 52-56 (2013)	
168	Vijayakumar, J; Mohan, S., Effect of benzyl alcohol and thiourea on electrodeposition of cadmium: electrochemical impedance spectroscopy study, *Trans. Inst. Metal Finish.*, **91,** 165-168 (2013)	
169	Subramanian, B; Ananthakumar, R; Yugeswaran, S; Jayachandran, M; Takahashi, M; Kobayashi, A., Suitability evaluation of plasma ion beam sputtered TiN/TiO_xN_y multilayers on steel for bio implants, *Vacuum* **88,** 108-113 (2013)	**1.530**
170	Nandi, R; Vikram, K; Singh, SK; Singh, B; Singh, RK., Synthesis and mesomorphic investigation of calamitic liquid crystalline system ethyl-[4-(4'-decyloxy)benzoyloxy]-benzoate (4-EDBB): A temperature dependent micro-Raman study and DFT calculations, *Vib. Spectrosc.*, **69,** 40-48 (2013)	**1.747**
171	Shukla A.K., Prem Kumar T., Nanostructured electrode materials for electrochemical energy storage and conversion, *Wiley Interdis. Rev. Ener. Environ.*, **2,** 14-30 (2013)	

HINDI MONTH CELEBRATIONS
हिंदी माह समारोह

संस्थान में दि.02 सितंबर से 03 अक्तूबर, 2013 तक हिंदी माह मनाया गया। इस हिंदी माह के दौरान 16 प्रतियोगिताएं आयोजित की गईं । जिसमें संस्थान के कर्मचारियों के साथ – साथ कनिष्ठ/वरिष्ठ अनुसंधान अध्येताओं, बी. टेक के छात्रों, डेटा एंटरी ऑपरेटरों ने भी उत्साहपूर्वक भाग लिया ।

ऑनलाइन प्रतियोगिताएं

पिछले वर्षों में आयोजित ऑनलाइन प्रतियोगिताओं की सफलता को देखते हुए इस वर्ष दैनिक हिंदी प्रश्नोत्तरी एवं साप्ताहिक वर्ग पहेली के साथ–साथ कुछ अन्य ऑनलाइन प्रतियोगिताओं का आयोजन भी किया गया । इन सभी प्रतियोगिताओं के उत्तर प्रतिभागियों ने ईमेल के माध्यम से दिए ।

(1) दैनिक हिंदी प्रश्नोत्तरी

हिन्दी माह का प्रारम्भ दि.02.09.2013 को आनलाइन दैनिक हिंदी प्रश्नोत्तरी और साप्ताहिक वर्ग पहेली प्रतियोगिता से किया गया। दैनिक प्रश्नोत्तरी के उत्तर स्वरूप कुल 400 से भी अधिक हिंदी/द्विभाषी ईमेल प्राप्त हुए, जो कर्मचारियों द्वारा यूनिकोड में टाइप करने की रुचि एवं प्रयास को दर्शाते हैं ।

(2)साप्ताहिक वर्ग पहेली

इसमें हर सप्ताह इंट्रानेट के हिंदी कॉलम में वर्ग पहेली प्रदर्शित की गई जिसका उत्तर कर्मचारियों ने निर्धारित तिथि तक दिया। पूरे माह में ऐसी तीन वर्ग– पहेलियाँ प्रदर्शित की गईं और समेकित रूप से सबसे अधिक अंक प्राप्त करने वालों को क्रमशः प्रथम, द्वितीय एवं तृतीय पुरस्कार दिए गए ।

(3) अनुभागध्प्रभाग प्रमुखों के लिए ऑनलाइन प्रतियोगिता

दि.06.09.2013 को अनुभाग/प्रभाग के प्रमुखों के लिए ऑनलाइन प्रतियोगिता का आयोजन किया गया । इसमें अधिकांश अनुभाग/प्रभाग प्रमुखों ने बड़े ही उत्साह से भाग लिया । इस प्रतियोगिता में अधिकारी–स्तर की टिप्पणियां पूछी गईं ।

(4) हिंदी ऑनलाइन अनुवाद प्रतियोगिता

दि. 11.09.2013 को हिंदी अनुवाद प्रतियोगिता – ऑनलाइन आयोजित की गईं । इसमें प्रशासनिक कर्मचारियों के साथ–साथ तकनीकी कर्मचारियों, वैज्ञानिकों ने भी भाग लिया ।

(5) सभी मुख्य वैज्ञानिकों के लिए ऑनलाइन हिंदी प्रतियोगिता

दि. 12.09.2013 को संस्थान के सभी मुख्य वैज्ञानिकों के लिए अधिकारी स्तर की टिप्पणियों पर एक ऑनलाइन प्रतियोगिता आयोजित की गई । इसमें प्रतिभागियों ने ईमेल के माध्यम से अपने उत्तर भेजे ।

इन ऑनलाइन प्रतियोगिताओं के अतिरिक्त निम्नलिखित प्रतियोगिताएं भी आयोजित की गईं ।

(6) अनुभागवार प्रतियोगिता

इसके अंतर्गत प्रत्येक प्रशासनिक अनुभाग के कार्य से सम्बद्ध प्रशासनिक शब्द के मिलान के साथ – साथ प्रतिभागियों ने अपने

अनुभाग पर पांच वाक्य लिखे और इसके साथ सुलेख भी लिखा। अनुभाग विशेष के लगभग सभी कर्मचारियों
ने इसमें भाग लिया। इस प्रतियोगिता के पुरस्कार भी अनुभागवार अलग–अलग रखे गए थे । इसके अंतर्गत निम्नानुसार कुल 08 प्रतियोगिताएं आयोजित की गईं –

भर्ती तथा सुरक्षा	दि. 11.9.13
वर्क एवं सा. तथा स्वागती	दि. 12.9.13
स्थापना – ईआरपी टीम	दि. 13.9.13
बिल तथा रोकड़	दि. 16.9.13
लेखा	दि. 18.9.13
भंडार	दि. 19.9.13
क्रय	दि. 23.9.13
अन्य नि. सचिवधनि. सहायक	दि. 24.9.13

गीत गायन प्रतियोगिता

दि.10.09.2013 को कर्मचारियों एवं बी.टेक के छात्रों के लिए हिंदी गीत गायन प्रतियोगिता आयोजित की गई । इसमें कर्मचारियों एवं बी.टेक के छात्रों ने हिंदी फिल्मी व देशभक्ति गीत व भजन आदि प्रस्तुत किए।

युवा वैज्ञानिक परिचर्चा

हिंदी दिवस विशेष के रूप में दि. 17.09.2013 को संस्थान के युवा वैज्ञानिकों के लिए विज्ञान और समाज विषय पर एक परिचर्चा का आयोजन किया गया । इसमें युवा वैज्ञानिकों ने बड़े ही उत्साह से भाग लिया और अपनी वर्तमान परियोजनाओं पर चर्चा करते हुए सम्बद्ध परियोजना से समाज को होने वाले लाभ के बारे में बताया ।

प्रश्नोत्तरी प्रतियोगिता

दि. 25.09.2013 को 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 एलेक्साण्डर, संरक्षा अधिकारी ने इस प्रतियोगिता का संचालन किया ।

कार्यशाला

दि. 28.09.2013 को कर्मचारियों के लिए हिंदी व्याकरण पर एक कार्यशाला का आयोजन किया गया जिसमें श्री कमलजीत सिंह, हिंदी प्राध्यापक हिंदी शिक्षण योजना, मदुरै ने कर्मचारियों को हिंदी व्याकरण समझाते हुए इसका अभ्यास भी करवाया।

हिंदी माह समापन एवं पुरस्कार वितरण समारोह

हिंदी माह, 2013 समापन एवं पुरस्कार वितरण समारोह दि. 03.10.2013 को अपराह्न 3.00 बजे संस्थान के विज्ञान प्रेक्षागृह में आयोजित किया गया।

डॉ. केएल.मुत्तुरामु, प्रधानाचार्य, शण्मुगनादन इंजीनियरिंग कॉलेज, अरसमपट्टी, तिरुमयम (पुदुकोट्टै) इस समारोह के मुख्य अतिथि थे । संस्थान के निदेशक डॉ. विजयमोहनन के. पिल्लै ने इस समारोह की अध्यक्षता की ।

सर्वप्रथम हिंदी माह आयोजन समिति के अध्यक्ष डॉ. के. तंगवेल ने मुख्य अतिथि एवं उपस्थित सभी का स्वागत किया । उन्होंने हिंदी माह के आयोजन का उद्देश्य और राजभाषा हिंदी के प्रयोग में हो रही वृद्धि पर प्रकाश डालते हुए सभी से अनुरोध किया कि वे हिंदी का उत्तरोत्तर प्रयोग सुनिश्चित करने का प्रयास करें ।

डॉ. विजयमोहनन के. पिल्लै, निदेशक, सीईसीआरआई ने समारोह के मुख्य अतिथि का शॉल एवं पुष्प गुच्छ से स्वागत किया ।

डॉ.विजयमोहनन के. पिल्लै, निदेशक ने अपने अध्यक्षीय भाषण में

कहा हम सभी का यह प्रयास होना चाहिए कि हम संस्थान में राजभाषा हिन्दी के प्रचार – प्रसार में अपना योगदान दें । उन्होंने कहा कि हिंदी माह के दौरान आयोजित विज्ञान और समाज विषय पर आयोजित हिन्दी परिचर्चा, मुख्य वैज्ञानिकों , प्रभागाध्यक्षों के लिए आयोजित प्रतियोगिताएं इस बात का प्रमाण हैं कि हमारा संस्थान इस ओर निरंतर आगे बढ़ रहा है। उन्होंने कहा कि यदि सभी बड़े अधिकारी हिन्दी में कार्य करेंगे तो निश्चित रूप से अन्य सभी के लिए यह एक प्रेरणा होगी। उन्होंने प्रसन्नता व्यक्त की कि स्थानीय उपयोग के लिए CSIR @ 80 : Vision & Strategy 2022 का हिन्दी अनुवाद किया गया तथा 27 जुलाई, 2013 को प्रो. समीर के ब्रह्मचारी, महानिदेशक, वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद, नई दिल्ली द्वारो इसका विमोचन किया गया।

उन्होंने यह आशा व्यक्त की कि भविष्य में भी हिंदी के प्रयोग के प्रति यह उमंग, उत्साह और सहयोग बना रहेगा।

श्री सोमेश्वर पाण्डेय, हिंदी अधिकारी ने प्रस्तुति के माध्यम से हिंदी माह 2013 एवं इसके अंतर्गत हिंदी के प्रयोग में हुई वृद्धि पर एक रिपोर्ट प्रस्तुत की ।

डॉ. केएल मुत्तुरामु, मुख्य अतिथि ने अपने भाषण में विज्ञान और भाषा के परस्पर महत्व पर प्रकाश डाला और अन्य देशों में उनकी अपनी भाषा में हो रहे शोध एवं प्रौद्योगिकी विकास का उदाहरण देते हुये हुए कहा कि आज आवश्यक है कि हम समग्र विकास के लिए विज्ञान के प्रचार–प्रसार हेतु जन – भाषा का प्रयोग करें। उन्होंने हिंदी माह आयोजन समिति के सभी सदस्यों तथा सभी प्रतिभागियों व पुरस्कार विजेताओं की उनके योगदान हेतु सराहना करते हुए हिन्दी माह के सफल एवं प्रभावी आयोजन के लिए बधाई भी दी।

तत्पश्चात हिंदी माह के अंतर्गत प्रतियोगिताओं के विजेताओं को पुरस्कार वितरित किए गए तथा प्रतियोगिताओं के निर्णायकों व संचालकों को उनके योगदान के लिए सम्मानित किया गया।

मुख्य अतिथि डॉ. केएल मुत्तुरामु, सीएसआईआर – सीईसीआरआई के निदेशक डॉ.विजयमोहनन के. पिल्लै, व. वैज्ञानिक डॉ. के. तंगवेल तथा श्री सी. क्रिस्तुराज, प्रशासन नियंत्रक ने विजेताओं को पुरस्कार प्रदान किए । संस्थान के प्रशासन नियंत्रक श्री सी.क्रिस्तुराज द्वारा धन्यवाद प्रस्ताव के साथ यह समारोह सम्पन्न हुआ।

नगर राजभाषा कार्यान्वयन समिति, कारैकुडी

सीएसआईआर– केंद्रीय विद्युतरसायन अनुसंधान संस्थान, नगर राजभाषा कार्यनवायन समिति, कारैकुडी का संयोजक कार्यालय है तथा सहयोगी कार्यालयों के सहयोग से नगर राजभाषा कार्यान्वयन समिति के माध्यम से नगर स्तर राजभाषा हिंदी के प्रचार–प्रसार हेतु प्रयासरत है। इन प्रयासों के अंतगर्त नियमित रूप से वर्ष में दो बार छमाही बैठकों का आयोजन किया जाता है तथा इन बैठकों राजभाषा विभाग के प्रतिनिधियों द्वारा सदस्य कार्यालय में राजभाषा कार्यान्वयन की प्रगति की समीक्षा की जाती है तथा राजभाषा नीति संबंधी मार्गदर्शन दिया जाता है । इसके अतिरिक्त नगर स्तर पर सदस्य कार्यालयों में अनुकूल वातावरण के निर्माण के उद्देश्य से संयुक्त प्रतियोगिताओं का आयोजन भी किया जाता है। वर्ष 2013–14 में दिनांक 30.04.2013 तथा 06.11.2013 को क्रमशः नगर राजभाषा कार्यनवायन समिति की 12 वीं एवं 13 वीं छमाही बैठक का आयोजन किया गया। इनमें नगर राजभाषा कार्यान्वयन समिति के सदस्य कार्यालयों के प्रतिनिधि, समिति के अध्यक्ष एवं निदेशक, सीएसआईआर – सीईसीआरआई डॉ. विजयमोहनन के.पिल्लै, डॉ. एन.पलनीस्वामी, वरिष्ठतम वैज्ञानिक एवं कार्यकारी अध्यक्ष, सीएसआईआर – सीईसीआरआई, श्री पी.विजयकुमार, सहायक निदेशक, क्षेत्रीय कार्यान्वयन कार्यालय, कोच्चिन,डॉ.वी.वी.कुचरु, मुख्य प्रबंधक, आंचलिक कार्यालय, सेंट्रल बैंक ऑफ इंडिया, चेन्नै तथा श्री सहदेव सिंह पूर्ति, वरिष्ठ राजभाषा अधिकारी, मंडल कार्यालय, दक्षिण रेलवे, मदुरै, श्री पंकज श्रीवास्तव, सदस्य सचिव, नराकास, मदुरै, श्री श्रीनिवासन तथा श्रीमती शहनाज हीरा, हिंदी अधिकारी, बीएसएनएल, मदुरै, बीएसएनएल, मदुरै विशेष रूप से उपस्थित थे ।

संयुक्त हिंदी प्रतियोगिताएं

नगर राजभाषा कार्यान्वयन समिति , कारैकुडी के तत्वावधान में दि.13.02.13 से दि. 20.02.13 तक कारैकुडी स्थित केंद्र सरकार के कार्यालयों, बैंकों, आदि के लिए संयुक्त हिंदी प्रतियोगिताओं का आयोजन किया गया । इसके अंतर्गत कुल 06 प्रतियोगिताएं आयोजित की गई । सीएसआईआर–केंद्रीय विद्युतरसायन अनुसंधान संस्थान द्वारा इसके अंतर्गत प्रश्नोत्तरी प्रतियोगिता आयोजित की गई तथा सदस्य कार्यालयों को अन्य प्रतियोगिताओं के आयोजन में आवश्यक सहायता प्रदान की गई। सभी सदस्य कार्यालयों के कर्मचारियों ने उपर्युक्त प्रतियोगिताओं में बड़े ही उत्साह के साथ भाग लिया । पिछले वर्षों की तुलना में प्रतिभागिता में वृद्धि हुई है और साथ ही आयोजक कार्यालयों की संख्या भी बढ़ी है।

पुरस्कार वितरण कार्यक्रम

दि. 30.04.13 की 12 वीं बैठक मे संयुक्त हिंदी प्रतियोगताएं –2013 के पुरस्कार विजेताओं तथा प्रतिभागियों को सीईसीआरआई, कारैकुडी के कार्यकारी निदेशक डॉ एन. पलनीस्वामी, उपाध्यक्ष डॉ. एम. सेल्वम तथा राजभाषा विभाग के प्रतिनिधि डॉ. पी. विजयकुमार तथा डॉ. वीवी. कुचरु, मुख्य प्रबंधक, आंचलिक कार्यालय, सेंट्रल बैंक ऑफ इंडिया, चेन्नै ने अपने करकमलों से पुरस्कार वितरित किए । इसके साथ ही इन प्रतियोगिताओं के आयोजक कार्यालयों को आयोजक–ट्रॉफी भी प्रदान की गई तथा प्रतियोगिताओं के निर्णायकों को भी सम्मानित किया गया ।

नराकास, कारैकुडी के राजभाषा समाचार के प्रवेशांक का विमोचन

नगर राजभाषा कार्यान्वयन समिति की दि. 06.11.2013 को आयोजित 13वीं छमाही बैठक में नराकास, कारैकुडी के अध्यक्ष डॉ. विजयमोहनन के. पिल्लै द्वारा नगर राजभाषा कार्यान्वयन समिति, कारैकुडी के राजभाषा समाचार के प्रवेशांक का विमोचन किया गया । उन्होंने सभी को बधाई देते हुए कहा कि नराकास की गतिविधियों में निरंतर वृद्धि हो रही है जो कि नगर स्तर पर सभी कार्यालयों में हिंदी के प्रचार–प्रसार को और व्यापक बनाने में निश्चित रूप से सहायक सिद्ध हो रही है । श्री पी. विजयकुमार, सहायक निदेशक, क्षेत्रीय कार्यान्वयन कार्यालय, कोच्चिन इस अवसर पर उपस्थित थे । उन्होंने इस प्रयास पर बधाई देते हुए कहा कि नराकास, कारैकुडी दिन प्रतिदिन और अधिक सक्रिय हो रही है । उन्होंने सभी कार्यालयों से इस सम्बंध में अपना पूरा सहयोग देने का अनुरोध करते हुए सभी को इस समाचार के प्रवेशांक के प्रकाशन की बधाई दी ।।

मुख्य कार्यक्रम

1) दिनांक 25 जुलाई, 2013(गुरुवार) को सीएसआईआर.सीईसीआरआई के विज्ञान प्रेक्षागृह में सीएसआईआर–सीईसीआरआई स्थापना दिवस मनाया गया। डॉ. पी आर वासुदेव राव, निदेशक, इंदिरा गांधी परमाणु अनुसंधान केंद्र, क्ल्पाक्कम ने द्रुत रिएक्टरों तथा सहसम्बद्ध ईंधन चक्र के लिए रसायन विज्ञान विषय पर स्थापना दिवस व्यख्यान दिया।

2) दिनांक 27 जुलाई, 2013 को राष्ट्र के माननीय वित्त मंत्री श्री पी चिदम्बरम ने प्रो. समीर के ब्रह्मचारी, महानिदेशक, सीएसआईआर की उपस्थिती में डॉ आर एम अलगप्पा चेट्टियार की प्रतिमा का अनावरण किया तथा केंद्रीय विद्यालय के रामानुजन ब्लाक का उदघाटन भी किया।

3) दिनांक 26 सितंबर, 2013 को सीएसआईआर स्थापना दिवस के अवसर पर डॉ राम पी बाजपेयी, कुलाधिपति, वेल टेक तकनीकी विश्वविद्यालय, चेन्नै तथा पूर्व निदेशक, सीएसआईआर.सीएसआईओ, चंडीगढ़ ने सीएसआईआर स्थापना दिवस व्यख्यान दिया। डॉ विजयमोहनन के पिल्लै, निदेशक ने इस समारोह की अध्यक्षता की ।

4) दिनांक 27.09.2014 को संस्थान में ओपेन डे मनाया गया तथा इस दौरान आम जनता तक विज्ञान एवं इसकी उपलब्धियों को पंहुचाने के लिए आम जनता के लिए सुबह 10.00 बजे से सायं 4.00 बजे तक वैज्ञानिक उपलब्धियों की एक प्रदर्शनी आयोजित की गई। विद्यालय एवं महाविद्यालय के कई छात्रों ने सीईसीआरआई के वैज्ञानिकों द्वारा बनाए गए प्रतिरूपों के माध्यम से आधुनिक वैज्ञानिक जानकरी हासिल की।

HUMAN RESOURCE STATUS AS ON 31.03.2014

Director

01. Dr. Vijayamohanan K Pillai

No	Name	Place of Working
CHIEF SCIENTISTS		
02	Shri. S. Ambalavanan	ECPS
03	Dr. I. Arulraj	ECPS
04	Dr. Bosco Emmanuel	EEC
05	Dr. M . Jayachandran	ECMS
06	Dr. N. Palaniswamy	C&MP
07	Dr. GT. Parthiban	C&MP
08	Dr. S. Pitchumani	Chennai Unit
09	Dr. G. Rajagopal	Chlor-Alkali
10	Shri. S. Ramu	C&MP
11	Dr. M. Selvam	EMFT
12	Dr. Sheela Berchmans	EEC
13	Dr. P. Sridhar	Chennai Unit
14	Dr. KN. Srinivasan	EMFT
15	Dr. P. Subramanian	C&MP
16	Dr.. R.H. Suresh Bapu	CIF
17	Dr. S. Syed Azim	C&MP
18	Dr. K. Thangavel	C&MP
19	Dr. D. Velayutham	Electro-Organic
SENIOR PRINCIPAL SCIENTISTS		
20	Dr. M.V. Ananth	ECPS
21	Dr. M. Chandrasekaran	C&M
22	Dr. S. Dheenadayalan	ECPS
23	Dr. M. Eashwar	Mandapam Unit
24	Dr. M. Ganesan	ECPS
25	Dr. V.V. Giridhar	EEC
26	Dr. S. Gopukumar	ECPS
27	Dr. R. Jagannathan	FM
28	Dr. D. Jayaperumal	C&MP
29	Dr. D. Jeyakumar	FM
30	Shri. S.P. Manoharan	C&MP
31	Dr. S. Maruthamuthu	C&MP
32	Shri. R. Meenakshisundaram	PPMG
33	Dr. S. Mohan	EMFT
34	Shri. S. Mohan	ETS
35	Dr. S. Muralidharan	C&MP
36	Shri. K. Muthu	C&MP
37	Dr. S. Muthukrishnan	C&MP
38	Dr. S . Muzhumathi	ECPS
39	Shri. V. Nandakumar	EHM
40	Dr. Nathira Begum	C&MP
41	Dr. M. Paramasivam	ECPS
42	Dr. P. Periasamy	ECPS
43	Dr. KLN. Phani	EEC
44	Dr. T. Prem Kumar	ECPS
45	Dr. G.Radhakrishnan	CNU
46	Shri. S. Radhakrishnan	CIF
47	Shri. R. Rajasekar	S&T
48	Dr. M . Raju	ECPS
49	Dr. T. Raju	Electro-Organic
50	Shri. M. Ramakrishnan	ECPS
51	Dr. B. Ramesh Babu	Pollution Control
52	Dr. GNK. Ramesh Bapu	EMFT
53	Dr. V. Saraswathy	C&MP
54	Shri. N. Sathaiyan	EHM
55	Dr. S. Sathiyanarayanan	C&MP
56	Dr. M. Selvaraj	C&MP
57	Dr. N.V. Shanmugam	EMFT
58	Dr. A. Sivashanmugam	ECPS
59	Dr. G. Sozhan	Electro-Inorganic
60	Dr. G. Subramanian	Tuticorin Unit
61	Dr. K. Subramanian	Chlor-Alkali
62	Dr. P. Veeramani	EMFT
63	Dr. T. Vijayabharathi	Electro-Organic

No	Name	Place of Working
PRINCIPAL SCIENTISTS		
64	Shri. R.V. Alagesan	TTBD
65	Dr. M. Anbukulandainathan	Electro-Organic
66	Dr. James Joseph	EEC
67	Dr. L. John Berchmans	EPM
68	Dr. N. Kalaiselvi	ECPS
69	Dr. J. Mathiyarasu	EEC
70	Dr. S.M. Rajendran	PPMG
71	Shri. RM. Sabarathinam	FM
72	Shri. KB. Sarangapani	ECPS
73	Shri. K. Saravanan	C&MP
74	Dr. R. Selvaraj	Civil
75	Shri. D. Sherwood	EEC
76	Dr. D. Vasudevan	EEC
77	Dr. S. Vasudevan	Electro-Inorganic
78	Dr. R. Vedalakshmi	C&MP
79	Shri. P. Venkatesan	C&MP
80	Dr. M. Vijayan	FM
SENIOR SCIENTISTS		
81	Dr. Alok Kumar Ramkrishna Paul	Chennai Unit
82	Dr. S. Angappan	EPM
83	Dr. S. Chellammal	Tuticorin Unit
84	Dr. M.V.T. Dhananjeyan	ECPS
85	Dr. Jonas Davidson	Electro-Inorganic
86	Dr. D. Kalpana	Chennai Unit
87	Shri. K. Manimaran	ECPS
88	Dr. A. Manual Stephan	ECPS
89	Dr. P. Murugan	FM
90	Dr. S.Palanichamy	Tuticorin Unit
91	Dr. A.S.Prakash	Chennai Unit
92	Dr. K. Ramesha	Chennai Unit
93	Dr. S. Ravichandran	Electro-Inorganic
94	Dr. Sailaja Krishnamurthy	FM
95	Dr. Santoshkumar D. Bhat	Chennai Unit
96	Dr. S.M. Silaimani	EMFT
97	Shri. Srinivasan Perumal	ETS
98	Dr. B. Subramanian	ECMS
99	Dr. V. Suryanarayanan	Electro-Organic
100	Dr. R. Thangamuthu	ECMS
101	Dr. Thirumalai Parthiban	CNU
102	Dr. S. Udhaya Bhanu	Pollution Control
SCIENTISTS		
103	Dr. Akhila Kumar Sahu	Chennai Unit
104	Dr. Deepak Kumar Pattanayak	Chlor-Alkali
105	Dr. V. Ganesh	EEC
106	Dr. G.V.M. Kiruthika	CIF
107	Dr. Kuldeep Singh	ECPS
108	Dr. N. Lakshminarasimhan	FM
109	Shri.A. Manokaran	Chennai Unit
110	Dr. C. Naveen Kumar	EMFT
111	Dr. A. Palaniappan	EEC
112	Dr. Rakesh Chandra Barik	C&MP
113	Shri. S. Santhakumar	CNU
114	Dr. M. Sathish	FM
115	Dr. S. Senthil Kumar	EEC
116	Dr. S.M. Senthilkumar	ECMS
117	Dr. Shailendra Kumar Jha	EMFT
118	Dr. C. Sivakumar	EEC
119	Dr. G. Sreedhar	EPM
120	Dr. S.S. Sreeja Kumari	C&MP
121	Dr. Subhendu Kumar Panda	EMFT
122	Dr. Subrata Kundu	ECMS
123	Dr. C. Suresh	EEC
124	Dr. S. Vengatesan	Electro-Inorganic
PRINCIPAL TECHNICAL OFFICERS		
125	Shri. K. Gopalakrishnan	Drawing Section
126	Shri. M.P. Gunasekar	ETS
127	Shri. S. Kannan	Civil
128	Shri. R. Kalidoss	CNU
129	Shri. K. Kumaravelu	ETS
130	Dr. N. Meyyappan	TTBD
131	Dr. S. Muralidharan	C&MP
132	Dr.. M. Murugesan	EEC
133	Smt. Nalini Thondiraj	CIF
134	Shri. R. Nandan	CIF
135	Dr. S. Palraj	C&MP
136	Dr. O.R.S.L. Sathiavathi	Health Centre

No	Name	Place of Working
137	Shri. PL. Shankar	ETS
138	Shri. S. Shanmugavelu	ETS
139	Dr. S. Vincent	CIF

SENIOR TECHNICAL OFFICERS (3)

140	Smt. K. Andal	CIF
141	Smt. M. Annalakshmi	CFE
142	Shri. AR. Elambarithy	ETS
143	Shri. KR. Karuppiah	E-Library
144	Shri. K. Kulangiappar	ECM
145	Smt. R. Mallika	TTBD
146	Shri. S. Manickam	TTBD
147	Shri. M.G.Neelavannan	C&M
148	Smt. Panjali Natarajan	CIF
149	Dr. K. Radha Krishnan	Horticulture
150	Shri. K. Rajendran	Civil
151	Shri. G. Ravichandran	Chennai Unit
152	Shri. S. Sekar	ECPS
153	Smt. Shanmugasigamani Srinivasan	EMFT
154	Shri. PR. Thangavelu	EMFT
155	Dr. R. Thirunakaran	ECPS
156	Shri. V. Venkatesan	Chennai Unit
157	Shri. B. Venugopal	HLS

SENIOR TECHNICAL OFFICERS (2)

158	Shri. K. Arumugasamy	C&MP
159	Shri. M. Balakrishnan	HLS
160	Shri. J. David Livingston	PPMG
161	Shri. P. Ganapathy	Tuticorin Unit
162	Shri. S. Gunasekaran	C-Library
163	Shri. N. Kalidas	C-Library
164	Shri. N. Karunanidhi	ICP
165	Shri. J. Kennedy	CIF
166	Shri. A. Madhava Mayandi	C&MP
167	Smt. G.Mallieswari	Health Centre
168	Shri. K. Maruthan	C&MP
169	Shri. V. Muthumani	ECPS
170	Shri. K. Muthuraman	C&MP
171	Shri.A. Rathish Kumar	CIF
172	Shri. M. Sakthivel	ETS
173	Shri. P. Seenichamy	ECPS
174	Shri. V.M. Shanmugam	CIF
175	Shri. S. Sivakumar	CFE
176	Shri. A. Selvaraj	CIF

SENIOR TECHNICAL OFFICERS (1)

177	Shri. T. Ashok Balamurugan	E-Library
178	Smt. P. Kalaiselvi	Tuticorin Unit
179	Shri. V. Raju	C&MP
180	Shri. R. Ravisankar	C&M
181	Dr. R. Sekar	EMFT
182	Shri. CT. Subramanian	CIF

TECHNICAL OFFICERS

183	Shri. R. Jeyaram	C&MP
184	Shri. M.S. Karthikeyan	C&MP
185	Shri. B. Pazhanivel	ETS
186	Shri. S. Shunmuga Sundaram	ETS
187	Shri. C. Venkatesh	Chennai Unit

TECHNICAL ASSISTANTS

188	Shri. S. Gomathynayagam	Civil
189	Shri. G. Gopi	ETS
190	Shri. G. Karthikeyan	Civil
191	Shri. P. Muthukumar	CNU
192	Shri. V. Prabu	CIF
193	Shri. R. Sugumar	CNU
194	Shri. M. Vadivel	ETS

SENIOR TECHNICIANS (2)

195	Shri. P. Kamaraj	CIF
196	Shri. R. Annamalai	ETS
197	Shri. A. Alagappan	ETS
198	Shri.A. Arumugam	ETS
199	Shri. K. Arumugam	EPM
200	Shri.S. Ashok Kumar	Chlor-Alkali
201	Shri.B.B.C. Babu	Telephone
202	Shri. RM. Balakrishnan	Director Office
203	Shri. B. Balaraman	ETS

No	Name	Place of Working
204	Shri. PN. Balasubramanian	Electro-Organic
205	Shri. A. Chandramohanan	CIF
206	Shri. G. Chandrasekaran	ETS
207	Shri. P. Chandrasekaran	ETS
208	Shri. T. Chockalingam	Works & General
209	Shri. E. Dakshinamoorthy	Chennai Unit
210	Shri. R. David Laxmanan	Photography
211	Shri. PJ. Dominic	Works & General
212	Shri. CT. Ganesamoorthy	Telephone
213	Shri. M.Ganesamoorthy	Chlor-Alkali
214	Shri. A. Ganesan	ETS
215	Shri. M. Ganesan	EHM
216	Shri. A. Gopalakrishnan	C&MP
217	Shri. S. Govindaraj	ETS
218	Shri. AR. Govindaraju	ETS
219	Shri. T. Jayaram	Madapam Unit
220	Shri. John palraj	ETS
221	Shri. S. Kannan	ETS
222	Shri. SP. Karthikeyan	S&T
223	Shri. A. Kasi	EMFT
224	Shri. K. Krishnamoorthy	Madapam Unit
225	Shri. S. Krishnan	TTBD
226	Shri. C. Kumarasamy	C-Library
227	Shri. R. Mohamed Abdul Kader	Stores
228	Shri. V.C. Mohana Kumar	ETS
229	Shri. S. Murali	TTBD
230	Shri. P. Murugesan	C&M
231	Shri. MS. Nagappan	ETS
232	Shri. AL. Nagarajan	ETS
233	Shri. R. Rajendran	ETS
234	Shri. S. Rajendran	EPM
235	Shri. P. Selvaraj	Works & General
236	Shri. M.N. Sen	ETS
237	Shri. M. Senthil Kumar	ETS
238	Shri. C. Sivam	Tuticorin Unit
239	Shri. S. Stepenson	ETS
240	Shri. L. Subbiah	Madapam Unit
241	Shri. G. Subramanian	CFE
242	Shri. P . Venkateswaran	ETS

No	Name	Place of Working
243	Shri. KP. Vijayan	Civil

SENIOR TECHNICIANS (1)

244	Shri. P. Boomi	ETS
245	Shri. M. Jayakkannan	CNU
246	Shri. P. Manikandan	ETS
247	Shri. K. Muniyandi	Electro-Organic
248	Shri. P. Sankar	ETS
249	Shri. M. Santhanam	ETS
250	Shri. C. Selladurai	ETS
251	Shri. V. Vedaraj	ETS

TECHNICIANS (2)

252	Shri. T. Arunkumar	CNU
253	Smt. S. Bagyalakshmi	CIF
254	Shri. S.T. James	ETS
255	Miss. S. Krithika	CIF
256	Smt. G. Bharathi Priya	Health Centre
257	Shri. N. Koodalingam	Works & General
258	Shri. V. Sagadevan	Works & General

LAB ASSISTANTS

259	Smt. N. Chellam	EMFT
260	Shri. C. Chockalingam	C-Library
261	Shri. S. Gopalakrishnan	C-Library
262	Shri. S. Karuppiah	Health Centre
263	Shri. K. Kumaravelu	Chennai Unit
264	Shri. S. Muthuravichandran	Works & General
265	Shri. M. Murugesan	ECMS
266	Shri. M. Nagarajan	Security
267	Shri. R. Nagarajan	HLS
268	Shri. RM. Raghu	CIF
269	Smt. R. Seethalakshmi	Pollution control
270	Shri. M. Senthil Kumar	EHM
271	Shri. KR. Sundar	EEC

LAB ATTENDANTS (2)

272	Shri. S. Selvaraj	Security

No	Name	Place of Working
LAB ATTENDANTS (1)		
273	Shri. K. Babu	Works & General
274	Smt. PR. Chellam	Electro-Inorganic
275	Shri. A. Gopu	Director Office
276	Shri. P.K. Kurumban	Safety Cell
277	Smt. C. Pothumponnu	Bills
278	Shri. T. Rajarathinam	Purchase
279	Shri. C. Seetharamanan	Chennai Unit
280	Smt. Vinutha Ramani	Works & General
ADMINISTRATION		
01	Shri. C. Christu Raj	COA's Office
02	Shri. K. Muraleedharan	AO's Office
03	Shri. D.P. Maret	FAO's Office
04	Shri. K.P.S. Ganapathy	SPO's Office
SECTION OFFICERS (G/F&A/S&P) & PRIVATE SECRETARY		
05	Shri. Anand Bharti	Estt. & DDO
06	Shri. A. Deenadayalan	Accounts
07	Shri. A. Ganeshan	Accounts
08	Shri. A.R. Kumaran	PS to Director
09	Smt. Meenakshi Easwaran	Section Officer
10	Shri. I. Sakthivel	PS to COA
ASSISTANT GRADE - I (G/F&A/S&P) & SENIOR STENOGRAPHER		
11	Smt. R. Bhanumathi	Works & General
12	Shri. A. Chidambaram	Accounts
13	Shri. A. Chinnaiah	Accounts
14	Smt.T. Chithradevi	Works & General
15	Shri. T. Ebenezer Rajendran	R&C
16	Shri. V. Elumalai	Chennai Unit
17	Shri. K. Gurusamy	Bills
18	Smt. M. Indudevi	Accounts
19	Smt. Jayanthi Thangamani	Accounts
20	Shri. Lakshminarayan Sunder	Purchase
21	Smt. M. Latha	Chennai Unit
22	Shri. R. Manikandan	Bills
23	Smt. M. Nageswari	Purchase
24	Shri. Y. Nagoor Gani	R&C
25	Shri. Najeeb V.I	Accounts
26	Shri. M. Nehru Pandiaraj	C&MPD
27	Smt. C. Parvathavarthini	Estt
28	Shri. NS. Radhakrishnan	Stores
29	Shri. R. Rajagopal	Stores
30	Shri. S. Ramakrishnan	Accounts
31	Smt. P. Saraswathi	CFE
32	Shri. K. Srinivasan	Estt.
33	Shri. C. Subramanian	Purchase
34	Smt. M. Tamilarasi	Bills
35	Smt. D.Umarani	Purchase
36	Shri. R. Uppili	PPMG
37	Shri. Vamsi Krishna	Director Office
38	Shri. K Venkatesan	Accounts
39	Smt. R.M. Vijayalakshmi	Works & General
40	Shri. V. Vijayaraj	R&C
ASSISTANT GRADE - II (G/F&A/S&P)		
41	Shri. CT. Chinnakaruppan	Accounts
42	Shri. M. Esakimuthu	Accounts
43	Smt. N. Geetha	Bills
44	Shri. P. Karuppiah	Bills & Estt.
45	Shri. P. Lakshmanan	Stores
46	Shri. S.V. Loganathan	Works & General
47	Shri. PL. Pandichockalingam	Works & General
48	Smt. K. Revathi Pushpam	Bills
49	Shri. K. Sivaraman	Director Office
50	Shri. I. Sreenu Sivakumar	Accounts
51	Smt. M. Suseela	Purchase
52	Smt. A. Vijayalakshmi	R&C
ASSISTANT GRADE - III (G/F&A/S&P)		
53	Miss C. Ramya	Cashier
54	Smt. N. Sornalatha	Accounts
HINDI		
55	Smt. G. Kalaivani	Hindi Cell

No	Name	Place of Working
56	Shri. K.R. Kumaresh Bapu	Senior Hindi Officer
57	Shri. Someshwar Pandeya	Hindi Officer

SECURITY

58	Shri. K. Meyyappan	Security
59	Shri. L. Thomas Alexander	Security Officer

ADMINISTRATIVE SUPPORTING STAFF

60	Shri. S. Balamurali	CIF
61	Shri. E. Deva Asirvatham	Canteen
62	Shri. R. Ganesh Kumar	Guest House
63	Smt. T. Geetha	Health Centre
64	Shri. M. Gnanaprakash	Canteen
65	Shri. P. Manoharan	Canteen
66	Shri. A. Mohammed Haroon	Guest House
67	Shri. V. Mohandass	Canteen
68	Shri. P. Murugiah	Canteen
69	Smt. S. Pappa	IMF
70	Shri. S. Sebastian	Canteen
71	Shri. A. Selvam Sethupathy	Canteen
72	Smt. M. Valli	C.O.A's Secretariat
73	Shri. R. Venkatesh	Health Centre

STAFF TRANSFERED FROM CECRI

Smt. P.P. Aleyamma
Senior Technical Officer (3)

Shri. M.V. Geethesh Menon
Senior Technician (2)

Shri. R. Chandrasekaran
Assistant

STAFF TRANSFERED TO CECRI

Shri. P. Muthukumar
Technical Assistant

Smt. A. Vijayalakshmi
Assistant (G)

Shri. M. Jeyakannan
Senior Technician (1)

Shri. C.T. Subramanian
Senior Technical Officer (1)

SUPERANNUATION

सेवानिवृत्ति

Shri. B. Arumugasundaram
S&PO

Shri. S. Sundaram
Asst.(G) Gr.I

Shri. K. Krishnan Kutty Nair
Sr. Technician (2)

Shri. A. Visuvasam
Sr. Technical Officer (3)

Shri. Cyril Stephen
Sr .Technical Officer (3)

Dr. Marikkannu
Chief Scientist

Shri. S. Govindu
Senior Scientist

Shri. S. Viswanathan
Asst.(G) Gr.I

Smt. G. Santha
Lab Assistant

Shri. P. Gowri
Wash Boy

Shri. K. Kalimuthu
Sr. Technician (2)

Dr. S. Dheenadayalan
Sr. Principal Scientist

Smt. PR. Chellam
Lab Attendant (1)

RESIGNATION & VOLUNTARY RETIREMENTS

त्याग पत्र एवं स्वैच्छिक सेवानिवृत्ति

Voluntary retirements

Shri. S. Murugesan
Asst. (G) Gr.I

Smt. N. Bhuvaneswari
Asst. (G) Gr.I

Death

Shri. M. Kasinathan
Senior Technician (2)
DOB: 03.05.1957 DOE: 08.09.2013

Shri. R. Saravanan
Lab Attendant (1)
DOB: 12.05.1976 DOE: 25.02.2014

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