February 2023

CSI Communication

Monthly Newsletter of Catalysis Society of India

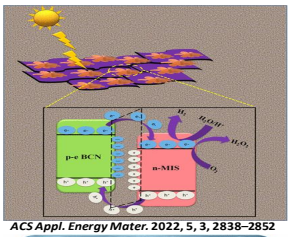
Circulated to all CSI Members

Important Announcement:

CSI newsletter shall be pleased to publish half a page write-up under the title, Centre of Excellence in Catalysis Research in India from any Indian Academics, Research laboratories or Industrial organizations. You may send your brief write-up on your research activities to us which will be published in coming issues of CSI.
You can also share your recent happy moments like publications, granted patents, technology commercialization, fellowship, awards, etc. to highlight in the CSI communication.

Dr.Kulamani Parida Group @ Centre for Nano Science and Nano Technology, Siksha 'O' Anusandhan University, Bhubaneswar

In present time, nanomaterials play an important role in the sector of sustainable energy and environmental remediation by reducing the carbon footprint through various budget and eco-friendly processes. Commensurate with the contemporary concerns for expanding the R&D activities in nanoscience and nanotechnology, and harnessing the new frontiers of knowledge, Centre for Nano Science and NanoTechnology (CNSNT) as one of the highly prolific research group of S O A (Deemed to be University), established in the year 2014 by the dynamic leadership of Prof. Manoj Ranjan Nayak (Chairman), a pioneer professor of Computer Science. The center aims to be a paradigm for training of students by offering Ph.D. degree in Chemistry and Nanoscience-Nanotechnology. It produces many bonafide scholars trained to solve challenging problems through effectual teaching of basic



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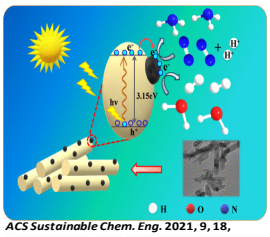
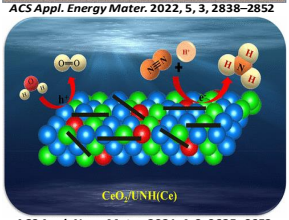
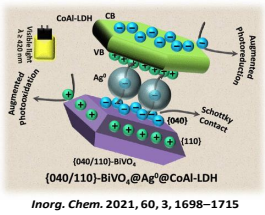


ACS Sustainable Chem. Eng. 2021, 9, 18,



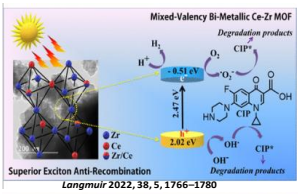
ACS Appl. Nano Mater. 2021, 4, 9, 9635–9652



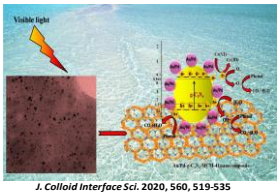
Inorg. Chem. 2021, 60, 3, 1698–1715

and fundamental principles of chemical, physical and nanotechnology for cutting-edge research by group leadership of Prof. Parida along with excellent and dynamic faculty. Moreover, students are trained for national and global leadership roles in academic, industry, and government sector by addressing the challenges towards the development of efficient materials in diverse field relating to energy, environment, and

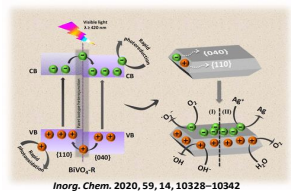
sustainability. This center is occupied with a group of Tenured faculty, Post Doc. fellow, CSIR-RA, and Ph.D. research scholars pursuing research in design and



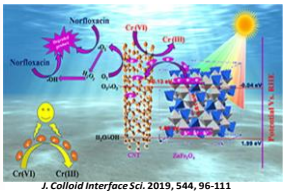
Langmuir 2022, 38, 5, 1766−1780



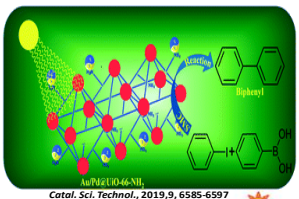
J. Colloid Interface Sci. 2020, 560, 519-535



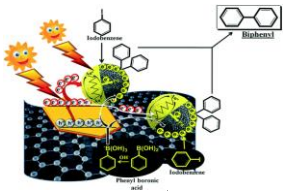
Inorg. Chem. 2020, 59, 14, 10328−10342



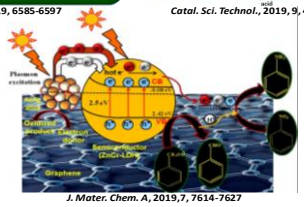
J. Colloid Interface Sci. 2019, 544, 96-111



Catal. Sci. Technol., 2019,9, 6585-6597



Catal. Sci. Technol., 2019, 9, 4678-4692



J. Mater. Chem. A, 2019,7, 7614-7627

fabrication of novel material by various advance synthesis techniques for harnessing materials (LDH, MoS_2, g-C_3N_4, MXene, black phosphorus, etc), Porous materials, Single crystals, Quantum dots, MOF, derived systems, and substrate growth of 2D/3D nanomaterials for photocatalytic (PC), piezocatalysis, photoelectrochemical (PEC), electrocatalytic (EC) and energy storage applications. Besides, the center has sophisticated advanced instrumentation facilities and top-quality laboratory infrastructure for pursuing cutting-edge research.

of solar energy towards sustainable production of hydrogen and oxygen energy, conversion of CO_2 /N_2 to fuel feedstock, O_2 photoreduction to H_2O_2, environmental pollutant abatement and fine chemical synthesis.

The major thrust area will be in the fabrication of dimensional/morphology oriented functional solids including layered The center has smart sitting rooms and procured high-end instruments for research with the financial support of the DST, SERB, MNRE and S'O'A (Deemed to be University) and also organizes various workshops, national and international conferences on thrust areas of nano-technology.

CNSNT Group Members

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www.kmparidaimmt.weebly.com

Commercial & Policies

- **India lists 13 activities for trading of carbon credits on global platform**

India has finalized its list of activities to be considered for trading of carbon credits under bilateral/ cooperative approaches in the international carbon market under the mechanism of the Paris Agreement on climate change. The final list for GHG mitigation includes areas like renewable energy with storage (only stored component), solar thermal power, off- shore wind, green hydrogen, compressed biogas, emerging mobility solutions, high end technology for energy efficiency, sustainable aviation fuel, use of best available technologies, tidal energy, high voltage direct current transmission in conjunction with the renewable energy projects. It means any entity can earn and accumulate credit through these selected cleaner activities and those credits can be traded on a global platform. Under the mechanism, high emitting industries/entities can buy credits from those who earned it through adopting those listed activities.

Source:https://timesofindia.indiatimes.com/india/india-lists-13-activities-for-trading-of-carbon-credits-on-global-platform/articleshow/98034464.cms

- **Payal Group ramp ups manufacturing capacity of chlorinated paraffins**

Payal Group inaugurated the 35 KTA of expansion for Chlorinated Paraffins production at India's only integrated plant of primary and secondary plasticizers manufacturing facility at Dahej, Bharuch, Gujarat. The commissioning of this project by Payal Group has expanded its capacity of chlorinated paraffins to 70 KTA making it among the top three manufacturers in India. This project has been envisaged to serve the thriving downstream PVC industry in the region and increase the exports of secondary plasticizers.

Source:https://www.indianchemicalnews.com/chemical/payal-group-ramp-ups-manufacturing-capacity-of-chlorinated-paraffins-to-70-kta-16468

- **Praj Industries Ltd. Sign MoU for Sustainable Aviation Fuel (SAF) projects in India**

Axens and Praj have signed a memorandum of understanding (MOU) to work jointly on projects in India for production of sustainable aviation fuel (SAF) from low carbon alcohols through alcohol-to-jet (ATJ) pathway. India is among top five aviation markets globally, and robust growth is expected over the next two decades. In its pursuit of Net Zero target, Government of India is mulling over introducing SAF mandates to decarbonize the aviation sector. The ASTM approved ATJ pathway (ATJ-SPK) involving conversion of low-carbon ethanol or low-carbon isobutanol into SAF will play a major role in meeting India's requirement of SAF production. Praj brings to the table proven expertise in modularized solutions, integration services for complete project and technology for production of low carbon isobutanol and ethanol from conventional bio-sourced feedstock. Axens will provide its Jetanol alcohol-to-jet technologies (dehydration, olefin oligomerization and hydrogenation steps), catalyst solution, equipment and services

(training, technical assistance) for conversion of alcohols to SAF.

Source: https://ethanolproducer.com/articles/19947/axens-praj-sign-mou-for-saf-projects-in-india

- **Jio-BP introduces E20 blended petrol2**

Jio-bp, a fuels and mobility joint venture between RIL and BP, has announced the initial rollout of E20 petrol. In line with the roadmap set by the government, Jio-bp has become one of the first fuel retailers in India to make E20 blended petrol available. Customers with E20 petrol compatible vehicles will be able to opt for this fuel at select Jio-bp outlets, and the offering will soon be expanded across the network. The E20 fuel is a twenty percent blend of ethanol and eighty percent of fossil-based fuel. E20 blending in petrol is being introduced in the country by the Government of India with the aim to reduce the country's oil import cost, energy security, lower carbon emission, better air quality, self-reliance, use of damaged food grains, increasing farmers' incomes, employment generation, and greater investment opportunities. Further, the government has advanced the target of E20 fuel from 2030 to 2025.

Source: https://www.indianchemicalnews.com/petro-chemical/jio-bp-introduces-e20-blended-petrol-16351

- **Sinopec launches China's first integrated methanol-to-hydrogen and hydrogen refueling station**

China Petroleum & Chemical Corporation (Sinopec) officially launched China's first methanol-to-hydro hydrogen refueling service station in Dalian, China. An upgrade from the previous fueling station offering oil, gas, hydrogen, electric charging services, the integrated complex can produce 1,000 kilograms of hydrogen a day, with a purity of 99.999 percent. Sinopec's hydrogen production plant has the advantages of covering a small area, having a short construction time, and having a green, environmentally friendly production process. The new service can save costs on hydrogen production, storage, and transportation by more than 20 percent compared to traditional hydrogen refueling stations, and it will become a pilot model to lead the development of China's hydrogen energy industry.

Source: https://www.indianchemicalnews.com/hydrogen/sinopec-launches-chinas-first-integrated-methanol-to-hydrogen-and-hydrogen-refueling-station-16513

- **Sulzer technology to recycle 30,000 tpy of plastic waste at Indaver's Plastics2Chemicals plant**

Sulzer advanced separation technology will enable end-of-life plastics recycling at Indaver's first plastic depolymerization plant currently under construction in Antwerp, Belgium. The new Plastics2Chemicals (P2C) plant will drive polymer circularity by using Sulzer separation technology to reclaim and purify 30,000 tpy of plastic waste. The resulting pure chemical feedstock can then be reused in manufacturing.

Indaver elected to partner with Sulzer in this project due to its extensive research and pilot testing at Sulzer Chemtech's in-house

pilot plant in Allschwil, Switzerland. Sulzer is delivering four units that will run proprietary processes to enhance the quality of the recovered styrene or oil fractions.

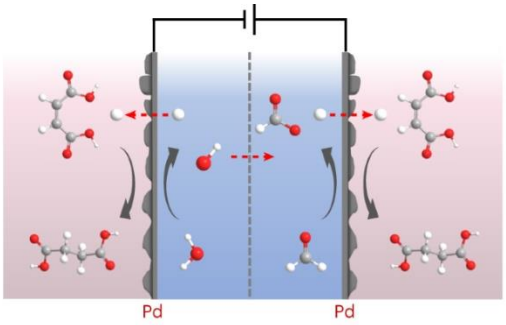
Source: https://www.hydrocarbonprocessing.com/news/2023/03/sulzer-technology-to-recycle-30-000-tpy-of-plastic-waste-at-indaver-s-plastics2chemicals-plant

Scientific Updates

- **Electrocatalytic dual hydrogenation of organic substrates with a Faradaic efficiency approaching 200%**

Bby taking advantage of the low-potential oxidation of formaldehyde on a palladium membrane anode to produce hydrogen that can permeate through the membrane electrode, electrocatalytic dual hydrogenation of unsaturated dicarboxylic acids is demonstrtaed to bepossible when another palladium membrane electrode is also adopted as the cathode. Such a design enables the electrocatalytic hydrogenation of the same substrate at both the anode and cathode in two separated chambers spatially isolated from the electrochemical cell with a theoretical maximum Faradaic efficiency of 200%.

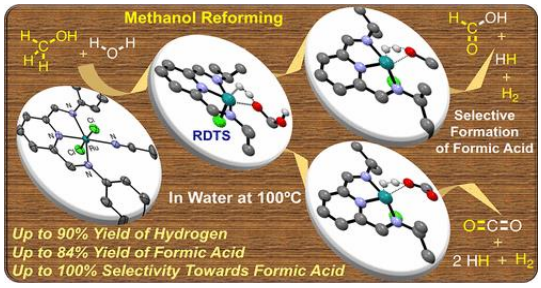
Source: Nature Catalysis (2023) https://doi.org/10.1038/s41929-023-00923-6



Electrocatalytic dual hydrogenation:
(1) low-voltage input, (2) 200% Faradaic efficiency, (3) ambient conditions and (4) facile separation

- **Pincer–Ruthenium-Catalyzed Reforming of Methanol Selective High-Yield Production of Formic Acid and Hydrogen**

A series of NNN pincer–ruthenium complexes of the type (R2NNN)$RuCl_2(CH_3CN)$ based on bis(imino)pyridine ligands were synthesized and characterized. These pincer ruthenium acetonitrile complexes, along with their phosphine and carbonyl counterparts, were tested for the reforming of methanol in water in the presence of a base. The catalyst (^{Cy2}NNN)$RuCl_2(PPh_3)$ was found to be the most efficient in comparison to other considered catalysts. The current catalytic system comprising of NNN pincer-ruthenium phosphines based on

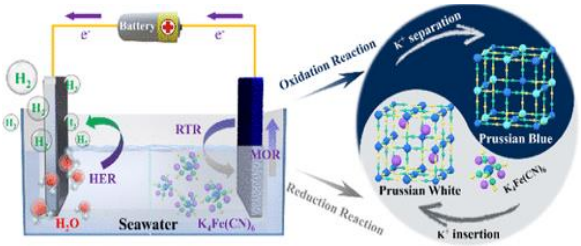


bis(imino)pyridine ligands that gives high yields of H2 and FA at unprecedented selectivity at low operating temperature offers immense promise in the transformation of methanol to clean-burning hydrogen and high-value FA.

Source: ACS Catal. 2023, https://doi.org/10.1021/acscatal.2c05587

- **Coupling Ferrocyanide-Assisted PW/PB Redox with Efficient Direct Seawater Electrolysis for Hydrogen Production**

Direct seawater electrolysis is a promising approach for grid-scale hydrogen mass production. However, the low energy efficiency and detrimental anodic chlorine electrochemistry unlock its practical potential. Here, researchers present an efficient chlorine-free hydrogen production by coupling the rapid electrode reaction of ferrocyanide-assisted Prussian white (PW)/Prussian blue (PB) redox with an onset potential of 0.87 VRHE. The chloride oxidation in our cells is avoided by low cell voltages, enabling high-purity hydrogen production. The assembled electrolyzer exhibited unprecedented performance for direct seawater electrolysis (pH = 8.5), achieving a current density of 320 mA cm^{-2} at 1.7 V. Therefore, the electricity consumed per cubic meter of H_2 produced in the

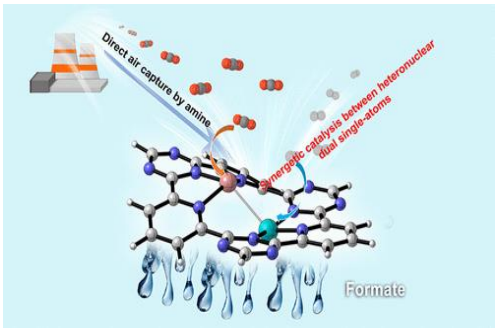


electrolyzer is 3.8 kWh at 200 mA cm^{-2}, and 42% lower energy equivalent input relative to commercial redox-free seawater electrolysis. This work offers a cost-competitive and energy-saving strategy for producing high-purity H_2 directly from unlimited seawater.

Source: ACS Catal. 2023, 13, XXX, 3692–3701
https://doi.org/10.1021/acscatal.2c05512

- **Heteronuclear Dual Single-Atom Catalysts for Ambient Conversion of CO_2 from Air to Formate**

Researchers propose heteronuclear dual SACs composed of Pd and 3d transition metals supported by covalent triazine frameworks (CTFs). Among these catalysts, the optimized Pd_1–Co_1/CTF catalyst exhibits up to 84.6% conversion of the captured CO_2 from air into formate at 30 °C and 1 bar. The in-situ DRIFT characterization and density functional theory calculations reveal that CO_2 in air is captured by the Et_3N solution as bicarbonate, which is then hydrogenated into formate via the Pd_1–Co_1 heteronuclear dual single atom with an energy barrier as low as 17.2 kcal/mol. The heteronuclear Pd and Co metal atoms act as the active site for



H_2 activation and CO_2 adsorption, respectively, thus exhibiting enhanced activity for formate synthesis with a synergistic effect.

Source: ACS Catal. 2023, 13, XXX, 3915–3924
https://doi.org/10.1021/acscatal.2c06033

Catalysis Research out of India

1. Apoorva M Ranjekar, Ganapati D Yadav, "Rice Husk Ash-Derived Ca-Mg-Modified Silicate as Support for Ni-Co for Hydrogen Production by Sorption-Enhanced Steam Reforming of Bioethanol" **Ind. Eng. Chem. Res. 2023, 62, 4, 1806–1818**
2. Apoorva M Ranjekar, Ganapati D Yadav, "Hydrogen production by steam reforming of methanol by Cu-Zn/CeAlO3 perovskite" **New J. Chem., 2023,47, 4860-4870**
3. Kranti N. Salgaonkar, Dr. Sandip R. Kale, Dr. Naresh Nalajala, Sayana Mansuri, Prof. Dr. Chinnakonda S. Gopinath, Selective and Generic Photocatalytic Oxidation of Alcohol with Pd-TiO2 Thin Films: Butanols to Butanal/Butanone with Different Morphologies of Pd and 0.5 θPt-Pd Counterparts", **Chemistry–An Asian Journal**, **2023** https://doi.org/10.1002/asia.202201239
4. I. Chauhan, Kshirodra Kr. Patra, Himanshu Bajpai, Nitin B Mhamane, Kranti N Salgaonkar, Chinnakonda S Gopinath, "Nanostructured Co-doped BiVO 4 for efficient and sustainable photoelectrochemical chlorine evolution from simulated sea-water", **Dalton Transactions 2023;** https://pubs.rsc.org/en/content/articlelanding/2023/dt/d2dt03369k/unauth
5. Rishi Verma, Rajesh Belgamwar, Pratip Chatterjee, Robert Bericat-Vadell, Jacinto Sa, Vivek Polshettiwar, "Nickel-Laden Dendritic Plasmonic Colloidosomes of Black Gold: Forced Plasmon Mediated Photocatalytic CO2 Hydrogenation", **ACS Nano 2023;** https://doi.org/10.1021/acsnano.2c10470
6. Manohar Akshay, Rajesh Belgamwar, S. Praneetha, Vivek Polshettiwar, V. Aravindan, "Defect Engineered Dendritic Fibrous Nanosilica as Prospective Alloy Anode for the Fabrication of High-Energy Li-Ion Capacitors with Ultralong Durability" **ACS Materials Letters, 2023, 5, 3, 715–721.**
7. Vijay P Mahajan, Yuvraj A Kolekar, Bhalchandra M Bhanage, "Magnetically separable Ni/Fe3O4: An efficient catalyst for phenoxy carbonylation of aryl iodides using bifunctional o-chlorophenyl formate as a CO source," **Applied Organometallic Chemistry, 2023;** https://doi.org/10.1002/aoc.7032
8. A. Ghosh, B. Chowdhury, Asim Bhaumik, "Synthesis of Hollow Mesoporous Silica Nanospheroids with O/W Emulsion and Al (III) Incorporation and Its Catalytic Activity for the Synthesis of 5-HMF from Carbohydrates" **Catalysts 2023, 13(2), 354;** https://doi.org/10.3390/catal13020354
9. Talla Venkata R. Mohan, a Palla Sridharb and P. Selvam, Experimental and modelling studies of carbon dioxide capture onto pristine, nitrogen-doped, and activated ordered mesoporous carbons, **RSC Adv., 2023, 13, 973-989**; https://doi.org/10.1039/d2ra07171a.
10. Talla V.R. Mohan, Madhu Nallagangula, Krishnan Kala, Carlos E. Hernandez-Tamargo, Nora H. De Leeuw, Kayambu Namitharan, Venugopal T. Bhat, Manickam Sasidharan, P. Selvam, Journal of Catalysis 419 (2023) 80–98; https://doi.org/10.1016/j.jcat.2023.02.005

11. Anindya Ghosh, Aniruddha Singha, Rupak Chatterjee, Thomas E Müller, Asim Bhaumik, Biswajit Chowdhury, "Influence of heteroatom-doped Fe-carbon sphere catalysts on CO2-mediated oxidative dehydrogenation of ethylbenzene" **Molecular Catalysis, 2023, 535, 15, 112836**

Upcoming Symposium/Conferences/Seminars

1. Catalysis Engineering & Technology (CET) meeting will be held from June-14-16, 2023 in Dubai, UAE along with The Catalysis Society of India (CSI) as Scientific Collaborator. **50% waive off on registration fee to CSI life members.**
2. ENSURE-2023 - International Conference on Environmental Sustainability through Waste and Recycling San Francisco, CA. April 10-12, 2023, https://wasteandrecycling.org/
3. World Conference on Carbon (Carbon 2023) Cancun, Mexico, 16-21 July 2023. www.Carbon2023.org
4. April 13-14, 2023-Chemical Catalyst 2023- 4th Global Summit on Catalysis and Chemical Engineering, Rome, Italy
5. April 17-19, 2023-ISSC-24 - Interdisciplinary Surface Science Conference, Manchester, United Kingdom

Announcements

- CSI Congratulates the following CSI members on the recognition they have received recently.

Name	Achievement
Padma Shri Professor Ganapati D. Yadav, *FTWAS, FNA, FNASc, FRSC (UK), FIChemE (UK), FIIChE* Emeritus Professor of Eminence & Former Vice Chancellor & R.T. Mody Distinguished Professor J.C. Bose National Fellow (Govt. of India), ICT Mumbai 	Received the **Lifetime Achievement award** of the Indian Drug Manufacturers Association in Mumbai on 24th Feb 2023

Editorial Team

Dr. Sharad Lande

Dr. Raksh Vir Jasra

Quote of the Month

"All our dreams can come true if we have the courage to pursue them."- **Walt**

For further information of CSI please visit, http://www.catalysisindia.org, https://www.begellhouse.com/journals/catalysis-in-greenchemistry-and-engineering.html & https://www.linkedin.com/groups/13923122/