April 2022

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.

Commercial & Policies

- **Boeing, SpiceJet, CSIR-IIP join hands to use sustainable aviation fuel**

Boeing, SpiceJet and CSIR-Indian Institute of Petroleum (IIP) are working together to explore opportunities for the use of Sustainable Aviation Fuel (SAF). The companies will work together to leverage SAF supply from CSIR-IIP and its production partners and licensees to help SpiceJet decarbonize its fleet. SAF can reduce CO_2 emissions by as much as 65 per cent over the fuel's life cycle with the potential to reach 100 per cent in the future.

Source: *https://www.thehansindia.com/business/boeing-spicejet-csir-iip-join-hands-to-use-sustainable-aviation-fuel-735126*

- **IOC to implement Poly-Butadiene Rubber Project at Panipat**

Indian Oil Corporation's (IOC) board has accorded approval for implementation of Poly-Butadiene Rubber (PBR) Project at its Naphtha Cracker Complex at Panipat at an estimated investment of Rs 1459 crore which is expected to be operational by 2025. The plant will have a PBR production capacity of 60,000 tonnes per annum based on state-of-the-art technology provided by Goodyear Tire & Rubber Company. Butadiene is the primary raw material to produce PBR which shall be available from existing Naphtha Cracker Complex of the Company.

Source: https://www.htsyndication.com/accord-fintech/article/ioc-gets-nod-to-implement-poly-butadiene-rubber-project-at-panipat/59256109

- **RIL arm to buy battery company Lithium Werks**

Reliance New Energy Limited (RNEL), a wholly owned renewable energy subsidiary of Reliance Industries Ltd (RIL), has signed a definitive agreement to acquire all assets of the Netherlands-headquartered Lithium Werks BV for a total transaction value of $61 million (Rs 468.2 crore)

including funding for future growth. Lithium Werks is a leading provider of cobalt free and high-performance lithium iron phosphate (LFP) batteries. LIP batteries, in addition to being the safest lithium battery type currently available in the market, offer a longer life span, no maintenance and are lightweight among others.

Source: https://economictimes.indiatimes.com/industry/renewables/ril-arm-to-buy-battery-company-lithium-werks-for-rs-468-2-crore/articleshow/90210383.cms?from=mdr

- **India to become the most important R&D center globally: ABB India**

Industrial technology providing company ABB is looking to boost its research and development (R&D) productivity making its Bengaluru-based center one of its biggest centers globally. ABB has interests in motion, electrification, process automation and robotics serving clients in cement, chemical, food and beverage, mining, oil and gas, power to name a few and is largely a B2B player.

Source: https://business-journal.in/companies/india-to-become-the-most-important-rd-centre-globally-abb-india-business-journal/

- **Evonik Expands Capacities for Petrochemical Specialties**

Evonik has invested a double-digit million euro sum to increase production capacity for isobutene derivatives at its Marl (Germany) location. The isobutene part of the C4 production network produces the petrochemical specialties tertiary butanol (TBA), Di-isobutene (DiB) and 3,5,5-trimethylhexanal (TMH). The expansion, which was recently completed, increases capacity for isobutene derivatives by more than 50%. The conversion work has increased the purity of the 3,5,5-trimethylhexanal produced in Marl from around 88% to more than 95%. In future, customers will be able to use the isobutene derivative directly in their own production process without having to purify it first. Source: Evonik, 3/30/2022.

- **Fourtitude™, a new BASF's FCC Catalyst maximizes Butylenes**

BASF has launched Fourtitude™, a new Fluid Catalytic Cracking (FCC) catalyst designed to maximize butylenes from resid feedstocks. Fourtitude, the latest product based on BASF's multiple framework topology (MFT) technology, is optimized to deliver superior selectivity to butylenes while maintaining catalyst activity. MFT technology enhances performance using more than one framework topology working together to tailor the catalyst selectivity profile. The superior butylenes selectivity is achieved by employing a specialty zeolite framework that is more effective at cracking small olefins to butylene. Fourtitude refinery trials have validated its ability to deliver improved performance for refiners through increased butylenes and propylene yields, increased gasoline octane, and improved coke selectivity. Source: BASF, 3/14/2022.

- **Braskem and Sojitz Corporation Join Hands to Bring Renewable MEG Technology to the Market**

Braskem and Sojitz, a Japan-oriented global trading company, have signed an agreement to establish a joint venture which will produce and market bioMEG (monoethylene glycol) and bioMPG (monopropylene glycol). Business plan includes the construction of three industrial units, with the startup of the first plant in 2025. The joint venture will combine Braskem's expertise in the industrial production and sale of chemicals and plastics made from renewable sources with Sojitz's strong presence in Asia, a region that concentrates 80% of the global MEG market and where its consumption registered the highest growth. Source: Braskem, 3/25/2022.

In 2017, Braskem partnered with Haldor Topsoe to demonstrate conversion of sugar into bioMEG and bioMPG. Continued development led to bioMEG first produced in 2020-- CSI

- **H2U Technologies Announces Joint Development Agreement with Leading Supplier of Catalyst Coated Membranes for Green Hydrogen Production**

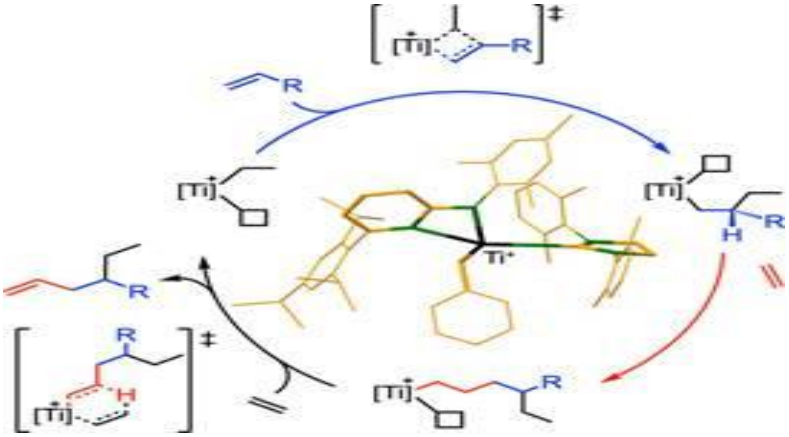
De Nora and H2U Technologies Inc. have announced their Joint Development Agreement (JDA) to examine the viability of newly identified non-platinum group metal (PGM) catalysts for green hydrogen production. These new catalysts will fill a critical gap in the development of low-cost green hydrogen, decreasing a significant cost barrier to growing the hydrogen value chain and promoting the energy transition. H2U's electrocatalyst compounds for OER and HER reactions show viability for low-cost, scalable green hydrogen production by eliminating PGM in water electrolysis. Source: H2U, 3/29/2022.

Scientific Updates

- **Catalyst for Sustainable Production of important Chemical Precursors alpha olefins.**

Researchers at the University of Bayreuth have developed a highly selective catalyst that for the first time makes it possible to produce, using ethylene, a potentially infinite number of variations of alpha-olefins with pinpoint accuracy. The new catalyst is based on titanium. Synthesis of alpha-olefins is essentially based on two construction principles, elongation and branching. These can be controlled very precisely with the new catalyst. The alpha-olefins used in this process differ in terms of their size and structure. The catalyst is a decisive breakthrough in terms of sustainable synthesis. It is highly selective for many, potentially infinite, variations of alpha-olefins. This outstanding selectivity is coupled with an unusually high efficiency. The Bayreuth catalyst can cleave a C-H bond 100,000 times per second at

room temperature and transfer the hydrogen atom to another molecule.

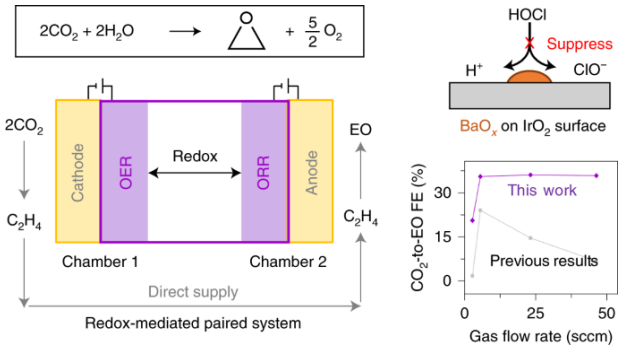


Mechanism and catalyst structure. Credit: Alex Goller

Source: chemeurope.com, 4/4/2022

- **Redox-mediated Electrosynthesis of Ethylene oxide from CO_2 and water**

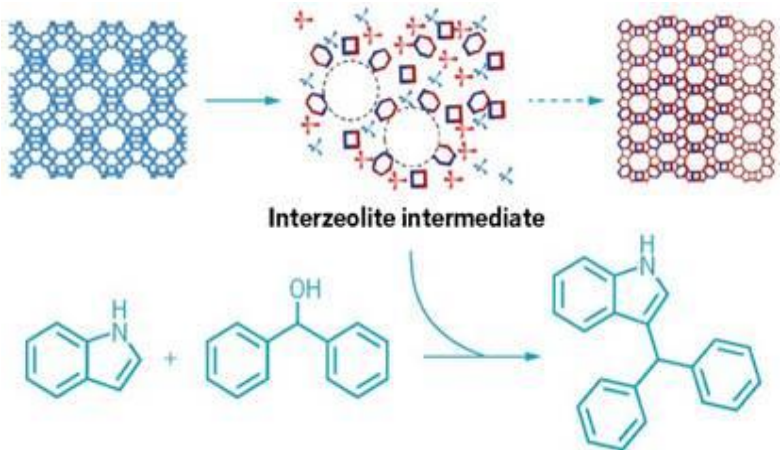
The electrochemical production of ethylene oxide (EO) from CO_2, water and renewable electricity could result in a net consumption of CO_2. Unfortunately, existing electrochemical CO_2-to-EO conversions show impractical Faradaic efficiency (FE) and require a high energy input. A class of period-6-metal-oxide-modified iridium oxide catalysts that enable us to achieve improved CO_2-to-EO conversion. Among barium, lanthanum, cerium, and bismuth, we find that barium-oxide-loaded catalysts achieve an ethylene-to-EO FE of 90%. When we pair this with the oxygen reduction reaction at the cathode, we achieve an energy input of 5.3 MJ per kg of EO, comparable to that of existing (emissions-intensive) industrial processes. We have also devised a redox-mediated paired system that shows a 1.5-fold higher CO_2-to-EO FE (35%) and uses a 1.2 V lower operating voltage than literature benchmark electrochemical systems.



Source: https://www.nature.com/articles/s41929-022-00749-8

- **Zeolite Intermediates Offer New Possibilities in Catalysis**

García Martínez's team used three established methods to obtain the interzeolite transformation intermediates (ITIs): using an organic template, a surfactant, or a combination of both strategies.



All are standard procedures for manufacturing mesoporous zeolites on industrial scales. The combination method creates a competition between the organic template and the surfactant, transforming zeolites considerably more slowly, which could be an advantage for controlling and monitoring the formation of ITIs. The researchers tried out the ITIs as catalysts in three popular acid-catalyzed reactions, including a Friedel-Crafts alkylation, a Claisen-Schmidt condensation, and polystyrene cracking. Overall, the turnover rate of the new catalysts was up to six times as fast as commercial zeolites. Source : Chemical & Engineering News, 3/21/2022.

- **Early-stage Evaluation of Catalyst Manufacturing Cost and Environmental impact using CatCost**

The costs and environmental impacts of catalyst manufacture are often neglected during early-stage research because of a lack of accessible, standardized tools to assess them. Here we report the key features of CatCost, a free and public estimation tool for the evaluation of catalyst cost. We demonstrate its functionality with a case study of diverse catalysts (ZSM-5, Pt/TiO_2 and Mo_2C) for the catalytic fast pyrolysis of biomass. We quantified the economic and environmental improvements made by replacing circulating-bed ZSM-5 with more stable, fixed-bed Pt/TiO_2 and Mo_2C catalysts, while revealing the effects of synthesis methods and production scale on catalyst costs. The manufacture of ZSM-5 had a large processing cost contribution that was strongly scale dependent, whereas the costs of the other catalysts were dominated by raw materials at all scales. Furthermore, while ZSM-5 costs the least per kilogram, the more stable catalysts cost half as much per gallon of fuel. Source : https://www.nature.com/articles/s41929-022-00759-6

Catalysis Research out of India

1. Jimil K. Johnson, Vineet Kumar Rathore, Sanjaykumar R. Patel, Naved Malek, and Parimal A. Parikh, “Volumetric and Acoustic Properties of Binary and Ternary Mixtures of Butanol Isomers with Gasoline Surrogate Compounds” **Chem. Eng. Data,** 2022, https://doi.org/10.1021/acs.jced.1c00747

2. Deepak S Desai, Ganapati D Yadav, "Solvent-free oxidative esterification of furfural to 2-methyl furoate using novel copper-exchanged tungstophosphoric acid supported on montmorillonite K-10 catalyst" **Molecular Catalysis,** 2022, 524, 112256
3. Bharati Debnath, Saideep Singh, Sk Mujaffar Hossain, Shrreya Krishnamurthy, Vivek Polshettiwar, Satishchandra Ogale, "Visible Light-Driven Highly Selective CO2 Reduction to CH4 Using Potassium-Doped g-C3N5" **Langmuir** 2022, 38, 10, 3139.
4. Arun D Kute, Rahul P Gaikwad, Indrajeet Warkad, Manoj B Gawande, A Review on Synthesis and Applications of Sustainable Copper-Based Nanocomposites, **Green Chemistry Reviews 2022** https://doi.org/10.1039/D1GC04400A
5. Sharda Kondawar, Chandrashekhar Rode, Ionic liquids for the sustainable transformation of levulinic acid to gamma-valerolactone (GVL), **Current Opinion in Green and Sustainable Chemistry 2022,** https://www.sciencedirect.com/science/article/abs/pii/S2452223622000190
6. Rajan Pandya, Rasika Mane, Chandrashekhar Rode, "Influence of Catalyst Reduction Temperature on Autogenous Glycerol Hydrogenolysis over NiAl Catalyst" Asian Journal of Organic Chemistry, 2022, 11(2), 191.
7. Nandan S Date, Chandrashekhar V Rode, Kuo-Wei Huang, Amol M Hengne, "Role of noble metal catalysts for transformation of bio-based platform molecules" **Biomass, Biofuels, Biochemicals** 2022, 641.
8. Shankar D Dhengale, Chandrashekhar V Rode, Govind B Kolekar, Prashant V Anbhule, "Synthesis of indeno-[1, 2-b]-quinoline-9, 11 (6 H, 10 H)-dione and 7, 7-dimethyl-10-aryl-7, 8-dihydro-5 H-indeno [1, 2-b] quinoline-9, 11 (6 H, 10 H)-dione derivatives in …" **RSC Advances** 12 (4), 2083-2093

Upcoming Symposium/ Conferences/Seminars

1. International Conference on Environmental Materials and Catalysis (CEMC 2022) 22-24 April 2022, Suzhou, China.
2. 2022-4-22: ICCCSTNE 2022: International Conference on Carbon Capture, Storage Technologies, and Negative Emissions.
3. Alternate Energy Materials-2022, 6-8 April 2022, Imperial College London, England. https://www.aemlondon.com/
4. 2nd Global Summit and Expo on Nanotechnology and Nanomaterials (GSENN2022) Copenhagen, Denmark on June 13-15, 2022. https://www.thescientistt.com/nanotechnology-nanomaterials/2022/speakers.php
5. International Conference on Environmental Materials and Catalysis (CEMC 2022) 22-24 April 2022 Suzhou, China
6. The 12th International Conference on Environmental Catalysis (ICEC2022) will be held during July 30-August 2, 2022, in Osaka, Japan.

Announcements

- CSI welcome the following newly joined life members

Sr. No.	Member Name	Life Membership Number
1	Dr. Rajib Bandyopadhyay	LM1082
2	Dr. BISWAJIT PANDA	LM1083
3	Dr. Swapnil Dharaskar	LM1084
4	Dr. Tarak Mondal	LM1085
5	Dr. Ashish Unnarkat	LM1086
6	Shri. Niraj Topare	LM1087

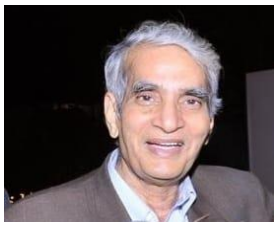
- CSI Congratulates the following CSI members on the recognition they have received recently.

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 	Selected for the award of **National Science Chair (NSC)** Mode-1, a scheme of Science & Engineering Research Board (SERB), Department of Science and Technology (DST) **April 2022**
Dr. Sharad Lande, FICS Assistant Vice-President (R&D) Reliance Industries Ltd. Mumbai 	Elected as a **Felllow of Royal Society of Chemistry, UK** **April 2022**

Tribute

Dr. T.S.R. Prasada Rao, Great Catalysis Scientist

(1939- 2022)



Dr. T.S.R. Prasada Rao, an internationally acclaimed catalysis scientist and an excellent technocrat passed away on 07th April 2022. Dr. Prasada Rao has made outstanding contributions in the field of petroleum refining, petrochemicals and heterogeneous catalysis in a career spanned over 40 years while working at Fertilizers Corporation of India (PDIL), Sindri, Indian Petrochemicals Corporation Limited, Baroda and as a Director, Indian Institute of Petroleum, Dehradun. His contributions through publications, patents, development of various catalysts and processes and their commercialization is recognized on various scientific forum. This is great loss to scientific fraternity especially for catalysis researchers for whom Dr. Prasada Rao was a role model. Dr. Rao has received many academic recognitions such as, Fellow of Indian National Academy of Engineering, and the Indian Academy of Sciences.

He was one of the founder pillars of the Catalysis Society of India (CSI) and served as the President of CSI for the year 1992-94 and CSI, Secretary for two years terms 1984- 1987 and 1988-1989. He represented India on council of International Congress on Catalysis.

Dr Prasada Rao has a wide circle of friends and admires in the research, academic, industrial, social, and cultural fields. His liveliness, the subtle charm and charisma endeared him to one and all without exception.

He was a great leader, motivator and truly people's manager. Request you all to pray for peace to the departed soul and strength to the family to bear this profound loss.

The Catalysis Society of India convey our heartfelt condolences to his family.

Editorial Team

Dr. Sharad Lande

Dr. Raksh Vir Jasra

Quote of the Month

"Winners are not those who never fail but those who never quit." — **Dr. APJ Abdul Kalam**