DEPARTMENT OF CHEMICAL ENGINEERING, IIT (ISM) DHANBAD

ChemE Chronicles

VOL.II No.4 *JANUARY* 2026 DEPARTMENTAL NEWSLETTER

FROM HOD'S DESK

PROF. ADITYA KUMAR

Dear friends and well-wishers,

Wishing all of you a very Happy New Year 2026!

It gives me great pleasure to introduce the January 2026 edition of ChemE Chronicles, the official newsletter of the Department of Chemical Engineering at IIT ISM Dhanbad. With each issue, the newsletter continues to enhance interaction and connection among students, alumni, faculty members, and well-wishers. I would like to express my heartfelt appreciation to all contributors for their dedication and efforts in bringing out this edition. This issue showcases a wide range of academic, research-oriented, and student-focused activities taking place within the department, with a special emphasis on frontier developments in carbon management, polymer recycling, and core chemical engineering operations.

The Alumni ChEnect section once again showcases the journey of a distinguished alumnus, currently serving as an Assistant Professor at IIT Jodhpur, and offers valuable insights into academic growth, international research exposure, and global engagement across Australia and Japan. Such narratives serve as a source of inspiration and guidance for our current students as they navigate their own professional pathways.

This issue also features enriching academic content through the ChemE Trivia and Feature Article sections, reinforcing the importance of strong fundamentals while connecting them to modern engineering challenges. The Feature Article highlights N0ET-2026 and its focus on net-zero emission technologies, while ChemE Trivia introduces to the practical aspects of pump selection and energy-efficient operation in chemical plants. In addition, the Chemical Engineering News segment covers breakthroughs such as a one-step CO_2-to-formic acid electrode and advanced PMMA recycling technology, underscoring the department's engagement with sustainable innovation.

As we advance into 2026, with a host of significant academic initiatives and conferences on the horizon, I urge our students and researchers to fully engage in interdisciplinary collaboration, embrace intellectual curiosity, and commit to ethical leadership. The dynamic field of chemical engineering demands not only technical excellence but also adaptability and a strong vision for sustainable development.

I hope this edition of ChemE Chronicles is both informative and inspiring. We welcome your feedback at che@iitism.ac.in as we enhance our platform for academic exchange and community connection.

What's Inside

Chemical Engineering News

Lummus & Sumitomo Launch Groundbreaking PMMA Recycling Technology

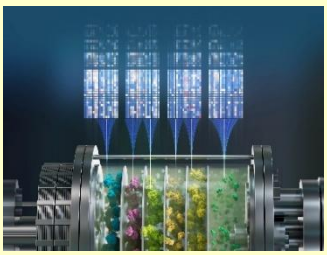
Lummus Technology and Sumitomo Chemical have unveiled a **next-generation recycling process for polymethyl methacrylate (PMMA)** — a widely used engineering plastic. This innovative technology enables efficient chemical recycling of PMMA waste back into high-purity monomers, significantly reducing environmental impact and supporting circular economy objectives in the polymer industry.

Read More..

New Electrode Converts CO_2 Emissions Into Useful Chemicals in One Step

Scientists have engineered an innovative electrode that captures CO_2 directly from exhaust and converts it to formic acid (a valuable industrial chemical) in a single integrated process — combining capture and conversion and potentially lowering costs for carbon utilization technologies

Read More..



*Please send your suggestions to: che@iitism.ac.in

Alumni ChEnect

Dr. Manoj Kumar Jena

M.TECH [2015-2017]

1 Welcome to the "Alumni ChEnect" interview series! Please tell us in detail about your current job.

As of January 2026, I am working as an Assistant Professor in the Department of Chemical Engineering at the Indian Institute of Technology (IIT) Jodhpur, Rajasthan, India. My role involves teaching undergraduate and postgraduate students, mentoring research scholars, and leading projects in my core areas

Q. Please tell us about your academic journey, starting from school days.

I come from a humble background and completed all my schooling in the Odia medium at a village primary and upper primary school in Odisha. Until the 10th standard, I had limited exposure to the outside world and future career possibilities. However, I always had a strong inclination toward technical subjects, which ultimately guided my academic choices.
After completing my 10th grade, I opted for the science stream in my 12th, driven by my interest in technology and engineering. In 2007, I appeared for the Odisha Joint Entrance Examination (OJEE) and secured admission into the B.Tech in Chemical Engineering program at the Indira Gandhi Institute of Technology (IGIT), Sarang, an autonomous government institute located just 5 km from my village. My decision to choose chemical engineering was motivated by its broad applications, job relevance, and potential for a stable, impactful career. Upon completing my B.Tech, I was placed at Tata Consultancy Services (TCS), India, where I worked as an engineer from 2011 to 2015. While this role offered valuable professional experience, my core interest in chemical engineering remained strong.
In 2015, I qualified the GATE examination and pursued an M.Tech in Chemical Engineering at the Indian Institute of Technology (Indian School of Mines), Dhanbad. During this period, I was introduced to research under the mentorship of Professor Vineet Kumar, which became a turning point in my academic life. Motivated by my growing passion for research, I went on to pursue a Ph.D. (2017–2022) through a joint doctoral program between Curtin University, Perth, Australia, and IIT (ISM), Dhanbad, India. I had the privilege of being jointly supervised by Professor Hari Vuthaluru at Curtin University and Professor Vineet Kumar at IIT (ISM). Following the completion of my Ph.D., I gained further international research exposure through postdoctoral fellowships at two esteemed institutions. From 2022 to 2024, I worked at RMIT University, Melbourne, Australia, under the supervision of Professor Kalpit Shah, where my research centered on advanced thermal processing and value-added product recovery from waste. Subsequently, from 2024 to early 2025, I joined the Tokyo University of Agriculture and Technology, Japan, where I focused on the design and modeling of thermochemical processes, working under Professor Chihiro Fushimi.

3 Why did you choose chemical engineering? Was it out of passion, or driven by circumstances? Please walk us through your thoughts as a Class 12 pass-out.
I was drawn to engineering due to my enjoyment of physics, chemistry, and mathematics in 12th standard. Living in a town surrounded by industries fueled my passion for chemical engineering. At that time, few institutes in Odisha offered a B.Tech in Chemical Engineering, including IGIT Sarang. Determined to pursue this path, I worked hard to achieve a good rank in the Odisha Joint Entrance Examination (OJEE) for admission into the program.

4 How has IIT (ISM) Dhanbad helped you in this journey? How did the BTech/MTech/PhD programme here help shape your career path? How did the academic environment and campus life contribute to your personal growth?

IIT (ISM) Dhanbad has been instrumental in shaping my academic and professional journey, especially through the Department of Chemical Engineering. My time at IIT (ISM) allowed me to earn my advanced degrees while enhancing my interpersonal and professional skills. I am grateful to the faculty for their support and guidance, which continues to inspire me. I enjoyed attending classes, serving as a teaching assistant, and engaging in meaningful research. The supportive environment and campus life greatly contributed to my overall growth.

5 What is your typical work-day like?
My typical day runs from 8:00 AM to 7:00 PM and begins with arriving at my office and planning for the day ahead, which includes both administrative responsibilities and research meetings. Usually in my working day, I deliver lectures, conduct UG/PG lab (if any), interact with students, and track their academic progress. I also spend a significant portion of my time preparing for upcoming lectures, writing research proposals, and visiting my laboratory to see ongoing work. I am generally a morning person, and I believe this greatly contributes to maintaining a healthy work-life balance.

6 What are the pros and cons of the profession in your honest opinion?

Well, my profession does involve several pros and cons. Based on my observation, the profession of academia is one of the most rewarding professions. The more effort and hard work you invest, the more you gain in return. It offers a platform for continuous learning and growth. Through impactful research, one has the opportunity to contribute meaningfully to society
and play a role in the development of the nation. On the other hand, there are some cons; however, I would not take true consideration, such as the chance of getting success is very limited and would take time, so someone needs to be very patient and needs to work really hard while enjoying it.

7 How has your career evolved since you graduated, and what advice would you give to current chemical engineering students aspiring to follow a similar path?

I am truly grateful for how my career has evolved since 2011. The journey has shaped me in many meaningful ways, ultimately allowing me to secure a faculty position at a premier institution in India—the Indian Institute of Technology Jodhpur. Even now, I continue to learn every day, and I look forward to growing further in the years ahead. I still have a long way to go, and I sincerely thank my incredible mentors and colleagues who have supported me throughout this journey.

My message to the students: Strengthen your understanding of core undergraduate courses—they form the foundation that will support you throughout your career, whether in industry or higher studies. Stay focused on what you're doing now and be clear about your future goals. Work hard, believe in yourself, and never take shortcuts—there are none in real life. If you remain committed and consistent, success will surely follow.

N0ET 2026 Conference

The Department of Chemical Engineering, Indian Institute of Technology (Indian School of Mines), Dhanbad, is set to host the fourth edition of the National Conference on Net-Zero Emission Technologies for Sustainable Development: Challenges and Opportunities (N0ET-2026) on 10–11 February 2026. The conference is being organized by the Department of Chemical Engineering.

N0ET-2026 will bring together researchers, industry leaders, policymakers, and young scholars to deliberate on emerging solutions for achieving net-zero targets. Key focus areas include carbon capture and utilization, renewable and clean energy systems, hydrogen and fuel cell technologies, sustainable process engineering, energy storage solutions, and environmentally responsible industrial practices. The conference will feature keynote and invited lectures by distinguished experts from leading academic institutions, research organizations, and industries across the country. These sessions will highlight recent technological advancements, translational research efforts, industrial implementation strategies, and policy perspectives aligned with sustainable development goals.

Sponsored by the Anusandhan National Research Foundation (ANRF) and organized in association with the TEXMiN Foundation, the event will host technical paper and poster presentations by researchers and industry personnel. It offers a dynamic platform for academic exchange, knowledge dissemination, collaborative engagement, and networking toward a sustainable, net-zero future.

Feature Article

Heat Exchangers: The Unsung Heroes of Chemical Engineering

Imagine you're cooking biryani and need to cool the hot rice quickly without wasting water—that's the magic of a heat exchanger in action! In chemical engineering, these devices transfer heat between two fluids (liquids or gases) without letting them mix. They're vital in power plants, oil refineries, food processing, air conditioners, and your car's radiator, ensuring energy-efficient temperature control. Why are they essential? Chemical processes generate heat from reactions or need it for distillation. Instead of dumping hot waste into the environment, heat exchangers recover it to warm cold streams, slashing energy costs and emissions. This aligns with sustainable engineering principles you'll study soon. The workhorse is the shell-and-tube heat exchanger. Envision tubes bundled inside a cylindrical shell, like straws in a giant thermos. One fluid zip through the tubes (tube side), the other flows around outside (shell side). Heat transfers via conduction through thin metal walls—no direct contact!

Key to efficiency is flow arrangement. Countercurrent flow (fluids move in opposite directions) maintains a large temperature gradient, achieving up to 90% heat recovery. Parallel flow is simpler but less efficient. It is calculated using the log mean temperature difference (LMTD)

$$Q = UA\Delta T_{lm}$$

where Q is heat duty, U is the overall heat transfer coefficient, A is surface area, and ΔT_{lm} is LMTD.

Plate-and-frame exchangers stack thin plates for high surface area in compact spaces—perfect for pasteurizing milk or Heating, Ventilation and Cooling (HVAC) systems. Double-pipe exchangers (tube-in-tube) suit small labs or high-pressure duties. Air-cooled exchangers use fins and fans for outdoor cooling, like in remote oil fields. Challenges include fouling (dirty buildup reducing heat transfer—mitigate with velocity control) and corrosion (choose alloys like stainless steel or titanium). Design software like Aspen HYSYS simulates these for optimization.

Prof. Khantesh Agrawal

ChemE Trivia

Pumps

Pumps are mechanical devices used to impart energy to fluids to overcome elevation differences, frictional losses, and pressure requirements in process systems, making them fundamental to fluid transport in chemical plants. Pump performance is characterized by the head–flow (H–Q) curve, and the operating point is determined by its intersection with the system resistance curve, directly linking pump design to piping network hydraulics. Centrifugal pumps operate by converting rotational kinetic energy from an impeller into pressure energy and are widely used for large flow rates at moderate pressures. Positive displacement pumps, including reciprocating and gear pumps, deliver nearly constant volume per cycle and are preferred for high-pressure, low-flow, or high-viscosity applications. Net Positive Suction Head (NPSH) is a critical parameter ensuring that inlet pressure remains above the vapor pressure of the fluid, preventing cavitation — the formation and collapse of vapor bubbles that can cause vibration and impeller damage. Pump efficiency consists of hydraulic, mechanical, and volumetric components, and overall efficiency depends on minimizing energy losses due to friction, leakage, and mechanical resistance. Dimensionless parameters such as Reynolds number, specific speed, and pump affinity laws are used for scaling, performance prediction, and selection under varying speeds and impeller diameters. Proper pump selection in chemical industries requires consideration of material compatibility, corrosion resistance, temperature limits, and energy consumption, as pumping systems account for a significant portion of industrial electricity usage.

In chemical plants, centrifugal pumps dominate due to their simplicity and ability to handle slurries or corrosive fluids when lined with alloys like Hastelloy or stainless steel. For example, in distillation columns, they move large volumes of hydrocarbons efficiently. Reciprocating pumps excel in metering precise chemical doses, while rotary lobe pumps manage shear-sensitive polymers. Parallel or series pump arrangements boost capacity or head for complex systems. Energy optimization follows affinity laws: halving speed quarters power needs ($P \propto N^3$,(aiding variable-speed drives (VSDs) for sustainability. Maintenance focuses on seals, bearings, and alignment to extend life cycles, reducing downtime in continuous processes.

IEI YOUNG ENGINEERS AWARD 2025

We are immensely proud to share that Prof. Sourav Sengupta from the Department of Chemical Engineering, IIT (ISM) Dhanbad has been selected for the IEI Young Engineers Award 2025. The IEI Young Engineers Award by the Institution of Engineers (India) is one of the most prestigious early-career recognition for engineers in India, that recognizes outstanding achievements/contributions made by young engineers (below the age of 35 years) in engineering research, excellence in engineering technology development, technology transfer, etc. Hearty congratulations to Prof. Sourav Sengupta for receiving the Award and bringing laurels to the Institute!

ISMAANA GANESH & PUSHPA THAKUR RESEARCH EXCELLENCE AWARD 2025

Prof. Ejaz Ahmad has been selected as the recipient of the **ISMAANA Ganesh & Pushpa Thakur Research Excellence Award** for this year, based on the recommendations of the Institute's selection committee. This highly esteemed award has been instituted by Dr. Ganesh C. Thakur, a distinguished alumnus of the 1970 batch (Petroleum Engineering), with the aim of recognising exceptional research excellence and sustained scholarly contributions by faculty members. The award carries a cash prize of USD 1,000, in addition to a commemorative plaque and a citation, reflecting the academic significance and prestige associated with the Honour. The award will be formally conferred during the felicitation ceremony on the Occasion of the Institute's Foundation Day, scheduled for 9 December 2025. Prof. Ahmad's selection for this award is a recognition of his impactful research contributions and unwavering commitment to academic excellence, bringing considerable distinction and pride to the Institute.

IMTR AWARD 2025

We are delighted to share that Sapan Kumar Pandit, Department of Chemical Engineering, IIT (ISM) Dhanbad, has been conferred with the IMTR Award this year. This prestigious recognition marks a significant milestone in his academic and research journey and reflects his outstanding contributions to research excellence.The IMTR Award is a prestigious recognition that honours exceptional academic and research achievements, acknowledging innovative contributions, research impact, and commitment to excellence. The award is presented to individuals who demonstrate high-quality research output and meaningful contributions to their field, making it a significant early-career milestone. Sapan Kumar Pandit expresses his sincere gratitude to the IMTR Award Committee for this honour. He also acknowledges the invaluable guidance, mentorship, and constant encouragement of his supervisor, Prof. Aditya Kumar, which played a pivotal role in this achievement. He further extends his thanks to the faculty members, mentors, and colleagues of the Department of Chemical Engineering, IIT (ISM) Dhanbad, for providing a stimulating and supportive research environment.