Sogang University-National Taiwan University

6th ChemE Symposium

2025.12.01 – 2025.12.03

Hosted by Department of Chemical Engineering, National Taiwan University

6th Sogang University- National Taiwan University Symposium

Annual SGU-NTU Symposium

1-3 December 2025, at NTU, Taipei, Taiwan

Monday-1st December 2025 **Location: Chemical engineering department, NTU**	
16:00-16:30	Arrival
16:30-18:00	Welcome, Campus/ Lab-tour, Chemical Engineering Department
18:30-	Welcome dinner

Tuesday-2nd December 2025 **Location: Room 103, Zheng-Jiang Hall, NTU**	
09:00-09:30	Warmup and Registration
09:30-09:40	Opening Remark & Group Photo
	Technical session 1 (Chair: Hyun-Seok Cho)
09:40-10:00	Lecture 1 (NTU) **Professor Chia-Chin Chen** Mixed Ionic-Electronic Conductors for Electrochemical Energy Storage
10:00-10:20	Lecture 2 (SGU) **Professor Jaegeon Ryu** Dual-ion Strategy for Extreme Fast-charging Batteries
10:20-10:40	Lecture 3 (NTU) **Professor Wen-Yueh Yu** Surface Chemistry of Heterogeneous Catalysts
10:40-11:00	Tea break
	Technical session 2 (Chair: Prof. Bor-Yih Yu)
11:00-11:20	Lecture 4 (SGU) **Professor Hyun-Seok Cho** Design strategy to improve catalyst utilization and two-phase transport in Polymer Electrolyte Membrane Water Electrolysis
11:20-11:40	Lecture 5 (NTU) **Professor Bor-Yih Yu** Comprehensive Technological Assessment of Lignin Conversion Processes
11:40-12:00	Lecture 6 (SGU) **Professor Heejong Shin** Integrating CO_2 Capture and Electrochemical Conversion toward Sustainable Fuels
12:00-13:30	**Lunch reunion & Connection**
13:30-16:00	**Students' poster presentations** (including 3 min flash presentation) **Chair: Prof. Bor-Yih Yu, Prof. Hyun-Seok Cho**
16:00-16:30	**Discussion for future collaboration / Closing remark** **Location: Room** 209**, Zheng-Jiang Hall, NTU**

	(From SGU) Prof. Taewook Kang, Prof. Hyuncheol Kim, Prof. Kyoung-Su Ha, Prof. Jaegeon RYU, Prof. Hyun-Seok Cho, Prof. Heejong Shin **(From NTU)** Prof. Dun-Yen Kang, Prof. Chu-Chen Chueh, Prof. Leigh Aldous, Prof. Bor-Yih Yu
16:30-17:30	Campus tour / Lab tour
17:30-	Dinner reunion & Connection

Monday-3rd December 2025 Location: Howard Hotel Suites	
09:00-	Meet at Howard Hotel Suites, and back to Taoyuan Airport
End of the Symposium	

*Drop off schedule might change due to unforeseen traffic, please consider the possibility of at least 30 minutes delay when booking your return flight.

Detailed Schedule for the Poster Session

Time	**Location: Room 103, Zheng-Jiang Hall, NTU Chair: Prof. Bor-Yih Yu, Prof. Hyun-Seok Cho**		
13:30 - 13:33	**No.01 (NTU) Cheng-Ying Li** Fabrication of bacterial cellulose rolls: A scalable bioprocess with broad applicability	14:15 - 14:18	**No. 13 (NTU) Shih-Yuan Su** Development of an Antioxidant Hydrogel Catheter Incorporating PEDOT:PSS for Nerve Repair.
13:33 - 13:36	**No.02 (SGU) Jonghyun Jeon** High Yield 3D Ordered Macroporous Pd/CeO2 Catalysts Designed for Plasma-Assisted e-Methanol Synthesis	14:18 - 14:21	No. 14 (SGU)**Youngheun Cho** Phospholipid Nanostructure-Inducing Albumin Nanoparticles for Overcoming Antibiotic Resistance
13:36 - 13.39	**No.03 (NTU) Pin-Ruei Li** Co-Generate Electricity During Heat Exchange with Thermogalvanic Cells	14:21 - 14:24	**No.15 (NTU) Pei-Shan Hsu** Large-Pore MOF Membranes via Vacuum-Driven Polymer Insertion for Carbon Capture and Hydrogen Purification
13:39 - 13:42	No.04 (SGU) **Jeongho Seong** Defective-Ligand Modulation in Co-gallate for Enhancing Adsorption Selectivity	14:24 - 14:27	**No. 16 (SGU) Jiwon Park** Conjugation of Biological Membranes with Conductive Nanocrystals for Improved Respiratory Chain Function
13:42 - 13:45	No.05 (NTU) **Chih-Wei Huang** Sustainable Insect Biorefinery: Process Simulation of Biofuel Production from Black Soldier Fly	14:27 - 14:30	**No. 17 (NTU) Hua-Ling Zhang** Effects of pH Regulation and Organic Modifier Concentration on the Retention Behavior of Amino Acids in Reversed-

			Phase Liquid Chromatography
13:45 - 13:48	No. 06 (SGU) **Jin Yong Kwon** Modulating Interfacial Network via Multifunctional Materials for Next-generation Battery System	14:30 - 14:33	**No. 18 (SGU) SeungHwan Roh** Heat-Assisted Direct Photopatterning of Small-Molecule OLED Emitters at the Micrometer Scale
13:48 - 13:51	**No. 07 (NTU) Yu-Chen Wen** Development of Mussel-Inspired Carboxymethyl Cellulose Hydrogel Doped with PEDOT:PSS for Application in Sensing Uric Acid Level in Human Sweat	14:33 - 14:36	**No. 19 (NTU) Yen-Yung Wu** Design of Reverse Osmosis Membranes for Molecular Separation: Size-exclusion vs. Adsorption-facilitation Mechanisms
13:51 - 13:54	No. 08 (SGU) **Ha-Young Lee** Microbial biogas valorization into $NaHCO_3$ and ectoine production	14:36 - 14:39	No. 20 (SGU) **Hwijoong Kim** Critical role of hydrogen doping for the stable operation of a-IGZO thin-film transistors under proton irradiation
13:54 - 13:57	**No. 09 (NTU) Pei-Chen Huang** Scalable Synthesis of UTSA-16(Zn) Crystals Using Oscillatory Flow Reactor	14:39 - 14:42	**No. 21 (NTU) Hung-Chen Huang** Co-Assembly with Donor-Acceptor Self-Assembled Monolayers to Enhance Interfacial Hole Extraction, Wettability and Crystallization in Inverted Perovskite Solar Cells
13:57 - 14:00	**No. 10 (SGU) Inseo Kim** Soft sensor development for real-time monitoring of microbial bioprocess	14:42 - 14:45	No. 22 (SGU) **Sang Jun Park** Polyampholyte Ionomers for Tailoring Product Selectivity in Electrochemical CO2 Reduction
14:00 - 14:03	**No. 11 (NTU) En-En Huang** Design of Visible light-crosslinked Caffeic Acid-Modified Gelatin Hydrogels and Characterization of Different Crosslinking Methods.	14:45 - 14:48	**No.23 (NTU) Cheng-Jui Yang** Simulation of Selective Adsorption of Copper Ions (Cu^{2+}) from Wastewater in a Fixed-bed Column.
14:03 - 14:06	**No. 12 (SGU) Jang-seob Lee** Development of a Robust Whole-Cell Biocatalytic Process for CO-to-Formic Acid Conversion via Extracellular Electron Transfer	14:48 - 14:51	No.24 (SGU) **Ji-Heon Kim** Design strategies for the mechanical enhancement of biologically synthesized polyhydroxybutyrate
14:06 - 14.15	Break	14:51 - 15:00	Closing

15:00 - 16:00	Poster exhibition

Speaker

Chia-Chin Chen, Associate Professor

Department of Chemical Engineering, National Taiwan University, Taiwan

Chia-Chin Chen is an associate professor in the Department of Chemical Engineering at National Taiwan University. His research focuses on solid-state electrochemistry, charge transport phenomena, interfacial kinetics, and mixed ion-electron conductors.

He received his Ph.D. in Chemistry from the Max Planck Institute for Solid State Research in Germany, following an M.S. in Chemical Engineering from the Illinois Institute of Technology and a B.S. in Chemical Engineering from National Taiwan University. Before joining NTU, he was a postdoctoral fellow in the Department of Materials Science and Engineering at Stanford University. His contributions have been recognized through honors such as the Yushan Young Scholar Fellowship, the 2030 Cross-Generation Young Scholars Award, and the Best Dissertation in Solid State Chemistry and Materials Science in Germany.

Mixed Ionic-Electronic Conductors for Electrochemical Energy Storage

Chia-Chin Chen

Department of Chemical Engineering
National Taiwan University
E-mail: chiachin@ntu.edu.tw

Mixed (ion-electron) conductors are solid materials that conduct both ionic and electronic carriers. This presentation will focus on how the fundamentals of mixed conductors could play a key role in determining the performance of lithium batteries. Besides introducing the conventional homogeneous mixed conductors, we will present a class of composite materials that enables storing lithium at the interface of two inert materials. Such composites, as they exhibit ultrafast kinetics, could pave the way for developing a new type of all-solid-state electrochemical cells reconciling energy density and power density.

In this study, a generalized theoretical and experimental framework is developed to elucidate charge transport and interfacial kinetics within composite electrode architectures. Electrochemical impedance spectroscopy, analyzed through an extended transmission line model, reveals non-ideal frequency responses and distributed relaxation time constants arising from interfacial selectivity, transport anisotropy, and geometric confinement. To directly correlate these effects with structural characteristics, X-ray microscopies are employed to reconstruct the three-dimensional microstructure of NCM-based composite electrodes containing solid electrolytes and conductive carbon networks. Operando visualization of concentration gradients during electrochemical cycling demonstrates that particle morphology, dimensional heterogeneity, and percolation connectivity critically regulate the spatiotemporal evolution of charge carriers. Collectively, these findings establish a fundamental framework linking transport phenomena, interfacial reaction kinetics, and microstructural complexity, thereby providing a quantitative basis for the rational design of next-generation solid-state battery electrodes.

Speaker

Jaegeon Ryu, Assistant Professor

Department of Chemical & Biomolecular Engineering, Sogang University, South Korea

Jaegeon Ryu is an assistant professor in the Department of Chemical and Biomolecular Engineering at Sogang University. He earned his Ph.D. from the Ulsan National Institute of Science and Technology in 2018. Afterward, he further engaged in electrochemical investigations of next-generation batteries for three years at Pohang University of Science and Technology (S. Korea) and Pacific Northwest National Laboratory (USA). His research focuses on developing advanced rechargeable batteries, such as beyond-Li, multivalent, dual-ion, etc., by designing the organic, inorganic, and hybrid materials along with cutting-edge in-situ/operando characterizations, while providing critical insights on lab-to-line transition in collaboration with world-leading cell makers.

Dual-ion Strategy for Extreme Fast-charging Batteries

Jaegeon Ryu

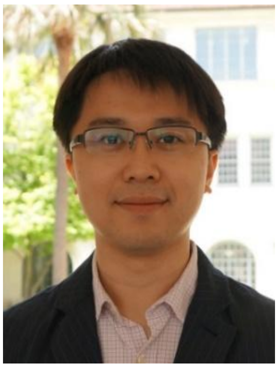
Department of Chemical and Biomolecular Engineering
Sogang University, Seoul 04107, Republic of Korea
E-mail: jryu@sogang.ac.kr

Charging conventional lithium-ion batteries in a comparable time frame to existing internal combustion vehicles has been a bottleneck for the widespread introduction of electric vehicles. For a single lithium-ion, its transport range inside a battery cell at a typical capacity loading exceeds 120 µm, which impedes the charging time and leads to a couple of side reactions, such as lithium metal plating onto the graphite anode and evolution of significant impedance. In this perspective, dual-ion batteries substantially curtail the charging time by driving the anions to be stored in a cathode during a charge while cations in an anode. The electrolyte components in the vicinity of host materials are directly inserted into the host materials, for example, anion intercalation into the graphite cathode. However, affording such a fast charging condition even in dual-ion batteries has been hindered by a structural deterioration of the graphite cathode during the intercalation of large-sized anions, imbalanced diffusion kinetics of anions and cations, and an unstable interface of the cathode surface at high-voltage. Here, we present a diverse strategy to enable the sustainable operation of dual-ion batteries with an extremely fast-charging capability and ultralong battery life span.

Speaker

Wen-Yueh Yu, Professor

Department of Chemical Engineering, National Taiwan University



Wen-Yueh Yu (Ph.D., University at Texas, Austin, 2015), is a professor in the Department of Chemical Engineering at National Taiwan University. Prof. Wen-Yueh Yu received his B.S. (2002) and M.S. (2004) both in Chemical Engineering from National Taiwan University. He then worked as a research assistant in the Institute of Chemistry, Academia Sinica, Taiwan from 2005 to 2009 before pursuing Ph.D. in Chemical Engineering at the University at Texas, Austin under the supervision of Prof. C. Buddie Mullins. He worked as a postdoc researcher in the group of Prof. Chih-Jen Shih in ETH Zurich in 2015. He joined the current department as assistant professor in 2017, and was promoted to professor in 2025.

Prof. Yu's research topics cover heterogeneous catalysis, surface science, in-situ spectroscopy characterizations, and functional nanomaterials. In the past five years, Yu research group has been working on the (1) non-reductive conversion of CO_2 with alcohols over CeO_2-based catalysts, (2) transfer hydrogenation of biomass derivatives using liquid hydrogen donors, (3) exploration of surface chemistry of nanostructured materials using in-situ characterizations, (4) catalytic removal of NO and NH_3, and (5) electrochemical hydrogenation of biomass derivatives.

Prof. Yu is the recipient of Chemical Engineering Excellence Award from Taiwan Institute of Chemical Engineers (2020, 2024), Best Paper Award from Catalysis Society of Taiwan (2021), Young Investigator Award from Taipei International Conference on Catalysis (2022), and Dissertation Supervisor Award (2023) and Aspiration Award in Excellent Academic Performance (2024) from National Taiwan University. Prof. Yu is the Early Career Researcher Editorial Board of *Materials Today Sustainability* since 2021, and the Editor of *Journal of Environmental Chemical Engineering* since 2024. As of 2025 Fall, Prof. Yu has published 62 SCI papers with a h-index of 27.

Group website: https://ntucatalysis.wixsite.com/yu-group

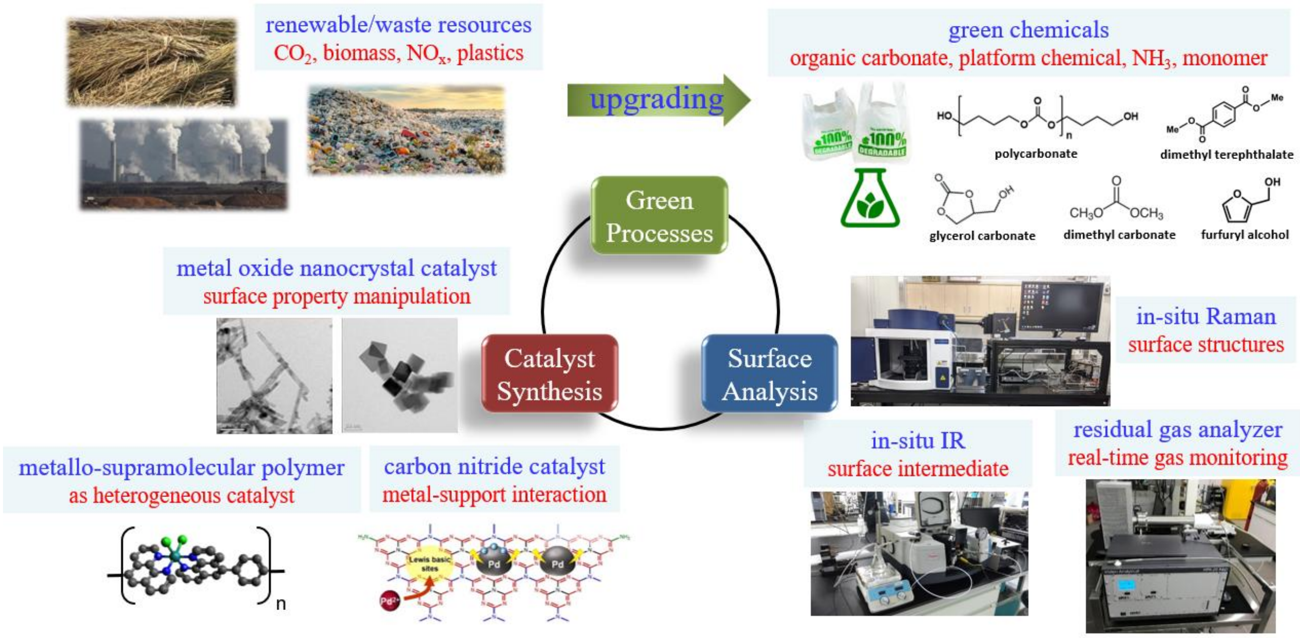
Surface Chemistry of Heterogeneous Catalysts

Wen-Yueh Yu

Department of Chemical Engineering, National Taiwan University

E-mail: wenyueh@ntu.edu.tw

A molecular understanding to surface events occurring on catalytic materials is beneficial to the development of emerging heterogeneous catalysts for energy and environmental applications. In this presentation, I will briefly introduce the surface science tools available in our group, and share a number of the fundamental insights into catalytic reactions that we have obtained from using these tools.



References

[1] CO_2 conversion on CeO_2: *Appl. Catal. B* (2020) 265, 118524; *Chem. Lett.* (2021) 50, 856; *Chem. Eng. J.* (2022) 430, 132941; *Mater. Today Sustain.* (2023) 23, 100425; *Chem. Eng. J.* (2024) 486, 150339.

[2] Transfer and electrochemical hydrogenation of biomass derivatives: *Catal. Sci. Technol.* (2020) 17, 7883; *Appl. Catal. B* (2022) 312, 121383; *Mater. Today Sustain.* (2022) 19, 100199; *Chem. Eng. J.* (2025) 506, 159800.

Speaker

Hyun-Seok Cho, Associate Professor

Department of Chemical & Biomolecular Engineering, Sogang University, South Korea

Hyun-Seok Cho (Ph.D., University of South Carolina, 2013), is an associate professor in the Department of Chemical and Biomolecular Engineering at Sogang University. He earned his Ph.D. from the University of South Carolina in 2013. His research focuses on analyzing degradation mechanisms through modeling and experimental work related to hydrogen production via electrochemical water electrolysis cells, fuel cells, corrosion, electrodeposition by electrochemical systems. From 2016 to 2023, he was a senior and principal researcher in the Hydrogen Research Department at the Korea Institute of Energy Research (KIER) in Daejeon. His research at KIER focused on low-temperature water electrolysis cells and stack design, including polymer electrolyte membrane and alkaline-type electrolysis cells.

Design strategy to improve catalyst utilization and two-phase transport in Polymer Electrolyte Membrane Water Electrolysis

Hyun-Seok Cho

Department of Chemical and Biomolecular Engineering
Sogang University, Seoul 04107, Republic of Korea
E-mail: hscho@sogang.ac.kr

Polymer electrolyte membrane water electrolysis (PEMWE) suffers from the use of expensive iridium-based anode catalysts. It is essential to reduce the amount of iridium while maintaining the water electrolysis performance and durability. Enhancing catalyst utilization by facilitating electron, ion, and mass transport in the anode is key to achieving this goal. In this regard, researchers have increasingly focused on developing microporous layers (MPLs) as a key strategy to enhance the interface between the porous transport layer (PTL) and catalyst layer (CL). However, a standardized design and manufacturing method for MPL has not been established yet.

Herein, we present a decal-transfer method, which is an effective means to introduce a uniform and thin MPL at the CL/PTL interface. By varying the MPL pore size, thickness, and back layer structure, we investigate two-phase transport phenomena in the MPL and establish guidelines for optimal MPL design. It is concluded that a smaller micrometer-scale pore size in MPL yields a higher catalyst utilization and stronger water capillary force that leads to lower kinetic and mass transport overpotentials. Besides, unless the back layer features a large MacMullin number and hinders the in-plane mass transport, the back layer structure barely makes a difference in the single-cell performance, highlighting the significance of the CL/PTL interface.)

Speaker

Bor-Yih Yu, Associate Professor

Department of Chemical Engineering, National Taiwan University

Bor-Yih Yu is currently an associate professor in the Department of Chemical Engineering at National Taiwan University (NTU) in Taipei, Taiwan. After earning his Ph.D. in Chemical Engineering from NTU, he worked in the Department of Chemical and Materials Engineering at Chang Gung University (CGU) and the Department of Chemical Engineering at the National Taiwan University of Science and Technology before rejoining NTU in August 2022.

Dr. Yu has been extensively working in the field of process systems engineering—specifically in process design, control, intensification, and multi-aspect evaluation. The goal of his research is to address significant engineering, economic, and environmental challenges through simulation techniques. In his early professional career, he has already published over 35 refereed articles (H-index = 17) and has participated in more than 30 research projects. His current research interests focus on the following topics: (1) Thermo-conversion processes of biomass; (2) CO_2 capture and utilization; (3) Solid-gas reactors; (4) Solid waste management and treatment; (5) Process intensification; and (6) Life cycle assessment. Additionally, Dr. Yu serves on the editorial boards of several journals, including ***Process Safety and Environmental Protection*** (IF=7.8, Rank=11% in ChemE), ***Separation and Purification Technology*** (Early Career) (IF=9.0, Rank =10% in ChemE), ***Cambridge Prism: Carbon Technologies***, and the ***Journal of the Chinese Institute of Engineers*** (IF=1.2, Q3 in Multidisciplinary Engineering).

Google scholar profile: https://scholar.google.com/citations?user=Zyl1Xd8AAAAJ&hl=en

Comprehensive Technological Assessment of Lignin Conversion Processes

Bor-Yih Yu
Department of Chemical Engineering, National Taiwan University, Taipei 10617, Taiwan
E-mail: boryihyu@ntu.edu.tw

Lignin constitutes 15% to 40% of lignocellulosic biomass and represents a major waste byproduct of the pulping industry and biorefineries. Owing to its complex and rigid architecture, lignin is difficult to chemically convert and is predominantly utilized as a fuel for heat and power. To valorize lignin, hydrothermal carbonization (HTC) and hydrothermal liquefaction (HTL) have been proposed as effective conversion methods. HTC primarily produces biochar, whereas HTL yields organic aromatic derivatives. However, progress in modeling these two processes has been limited; most existing studies rely on lumped kinetic models or experimental yields for flowsheet design. To address this gap, the present study rigorously developed HTC and HTL processes for lignin. Comprehensive kinetic models, based on representative model compounds and prior research findings, were established for each process. Predictive thermodynamic methods were employed to estimate the physical properties of pure model compounds and their resulting mixtures. Subsequently, process design and optimization were conducted using the developed kinetic and thermodynamic models. Finally, integrative life cycle assessment (LCA) and techno-economic analysis (TEA) were performed on the optimized process configurations.

Speaker

Heejong Shin, Assistant Professor

Department of Chemical & Biomolecular Engineering, Sogang University, South Korea

Heejong Shin (Ph.D., Seoul National University, 2020) is an assistant professor in the Department of Chemical and Biomolecular Engineering at Sogang University. He received his Ph.D. from Seoul National University in 2020, after which he worked as a postdoctoral researcher at the Center for Nanoparticle Research, Institute for Basic Science (IBS) in Korea (2020–2022), and later as a postdoctoral researcher in the Department of Chemistry at Northwestern University from 2023 to 2025. His research focuses on developing innovative electrochemical materials and systems for energy conversion applications, with an emphasis on understanding and controlling electrode–electrolyte interfacial dynamics to design efficient and durable electrocatalytic processes. He integrates fundamental mechanistic insights with full-cell electrolyzer engineering to advance electrified pathways for producing fuels and chemical feedstocks, ultimately enabling low-carbon and sustainable chemical manufacturing.

Integrating CO_2 Capture and Electrochemical Conversion toward Sustainable Fuels

Heejong Shin

Department of Chemical and Biomolecular Engineering
Sogang University, Seoul 04107, Republic of Korea
E-mail: hshin@sogang.ac.kr

The electrochemical reduction of CO_2 offers significant promise for the sustainable production of valuable chemicals and fuels, providing a pathway toward large-scale electrified manufacturing. In this work, we present an emerging approach that integrates CO_2 capture and conversion by directly reducing chemisorbed carbon species from a capture medium—an emerging strategy known as "reactive capture". Unlike conventional multistep processes involving sequential CO_2 separation, electrolysis, and product purification, our method enables one-step reactive CO_2 capture for more efficient fuel production.

Our research centers on three major objectives: (i) developing direct air capture processes using amine- or hydroxide-based solvents to extract CO_2 from ambient air; (ii) implementing bipolar membrane electrodialysis (BPMED) and/or an auxiliary electrochemical cell to regulate the pH of electrolyzer feed streams while concurrently regenerating the capture solvent; and (iii) advancing electrocatalyst design for the electrochemical conversion of amine-/carbonate-derived CO_2 into CO with high activity and selectivity. Additionally, we aim to establish an integrated platform for CO_2-to-fuel conversion by combining high-throughput nanomaterial synthesis, catalyst screening, and system-scale development. Ultimately, this research seeks to optimize electrocatalysts and device architectures for producing long-chain transportation fuels directly from CO_2, contributing to a sustainable energy future through the integration of renewable electricity with advanced catalyst and reactor technologies.