

2025 ENSOR LECTURESHIP

FEATURING

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Oct. 28 | 12:00 p.m. | CUB Sr. Ballroom

Reception: 10:30 a.m.–12:00 p.m. | CUB Sr. Ballroom

Upgrading CO₂ and Biogas to Value-added Products via Tandem Catalytic Strategies

Converting CO₂ to value-added products is one of the most practical routes for reducing CO₂ emissions while fossil fuels continue to dominate the energy sector in the foreseeable future. Thermochemical conversion of CO₂ into value-added products, such as olefins, oxygenates and carbon nanofibers, requires the utilization of molecular H₂. In order to achieve a net-negative CO₂ footprint, H₂ needs to be produced from water electrolysis instead of from hydrocarbon sources. However, large-scale deployment of water electrolysis in acidic electrolytes is hindered by the high cost of precious metal electrocatalysts, such as platinum (Pt) for the hydrogen evolution reaction (HER) at the cathode and iridium (Ir) for the oxygen evolution reaction (OER) at the anode. In the first part of this talk, we will discuss our recent efforts in developing cost-effective HER and OER electrocatalysts. We will also discuss tandem processes involving generating H₂ from an electrochemical reactor and its subsequent use for CO₂ conversion in a thermochemical reactor.

In addition to CO₂, upgrading decentralized biogas (CH₄ and CO₂) represents a sustainable route to simultaneously mitigate two potent greenhouse gases. Due to reaction thermodynamics, the conversion of biogas to value-added products cannot be achieved effectively using a single reactor. In the second part of this presentation, we will discuss the conversion of CO₂ or biogas using tandem thermochemical and electrochemical reactors to produce carbon nanofibers. We will demonstrate the potential advantages of tandem processes, including reducing reaction temperatures, shifting equilibrium limits, and generating products that cannot be achieved using a single reactor. We will also discuss general tandem strategies involving thermocatalysis, electrocatalysis, biocatalysis and plasma-activated catalysis for the upgrading of CO₂ and light alkanes.

Jingguang Chen is the Thayer Lindsley Professor of Chemical Engineering at Columbia University, with a joint appointment at Brookhaven National Laboratory. He received his B.S. degree from Nanjing University and his PhD degree from the University of Pittsburgh. After finishing an Alexander von Humboldt postdoctoral fellowship in Germany, he joined the Exxon Corporate Research Laboratory for several years. He started his academic career at the University of Delaware and rose to the rank of the Claire LeClaire Professor of Chemical Engineering and the Director of the Center for Catalytic Science and Technology. He is the co-author of over 500 journal publications and over 20 United States patents. His research interests include fundamental understanding of carbides, nitrides and bimetallic catalysts for applications in thermocatalysis and electrocatalysis. His research group utilizes a combination of experimental studies, in-situ characterization and density functional theory calculations.

He served in many leadership positions, including the Chair of the Catalysis Division of the American Chemical Society, the President of the North American Catalysis Society, and the Chair of Gordon Research Conference on Catalysis. He was a co-founder and the director of the Synchrotron Catalysis Consortium, which was established in 2025 with support from the Department of Energy to assist catalysis researchers to utilize synchrotron techniques. He is an Executive Editor of *ACS Catalysis* and has been on the editorial advisory boards of many journals. He received the George Olah Award on Hydrocarbon Chemistry from the American Chemical Society, the Robert Wilhelm Award on Chemical Reaction Engineering from the American Institute of Chemical Engineers, and the Robert Burwell Lectureship from the North American Catalysis Society. He is a member of the National Academy of Engineering.



THE ENSOR LECTURESHIP was established through the generosity of David Ensor and his wife, Sara, as a reflection of their deep interest in higher education and their strongly held belief in the empowerment that education provides for one's life.

After graduating with a bachelor's in chemical engineering from WSU in 1963, David Ensor received his master's and Ph.D. at the University of Washington. Ensor is an expert in aerosol and air pollution science, applying his aerosol expertise to nanotechnology research and international standards development as a U.S. delegate to the International Organization for Standardization.

Ensor worked for Meteorology Research, Inc., and recently retired from a long career at RTI International. He is one of the founding editors of *Aerosol Science and Technology* and has received several awards, including the White House's Hammer Award and the Meritorious Service Award from the American National Standards Institute.

