

2025 George Rieveschl Jr. Distinguished Seminar Series in Membranes and Separations

High-Temperature Air Separation: Membrane vs. Sorption Processes — Which Is More Effective?

Presented by Professor Dr. Jerry Y.S. Lin

School for Engineering of Matter, Transport and Energy Arizona State University, Tempe, AZ 85287



When: October 31st, 2025

Reception: 12:00 PM – 12:20 PM, Foyer 427 Mantei Hall

Seminar: 12:20 PM – 1:30 PM, 427 Mantei Hall

Abstract

Air separation to produce oxygen, nitrogen, and other gases is essential to a wide range of industries and critical human services. Metal oxides with cubic lattice structures—such as perovskite, brownmillerite, and fluorite-type materials—are notable for their significant oxygen deficiencies and electronic conductivity. Among these, perovskite ceramics have garnered particular attention as membranes or adsorbents for air separation due to their mixed ionic and electronic conductivity at elevated temperatures. This unique property allows for the simultaneous transport of oxygen ions and electrons, making them highly effective for high-temperature applications. Over the past three decades, these materials have been the subject of extensive research as oxygen-selective membranes or adsorbents for gas separation and catalytic processes. Numerous research groups, including our own—particularly during our time at the University of Cincinnati—have contributed to advancing this field. These systems are designed for high-temperature air separation, supporting the production of oxygen and nitrogen as well as enabling selective oxidative reactions, including oxy-fuel combustion for power generation with integrated carbon dioxide capture. This presentation will explore the fundamental principles of oxygen permeation and sorption in these classes of metal oxides. It will also compare the advantages and limitations of membrane and sorption-based processes and conclude with perspectives on the future development and application of these technologies.

Short Biography

Jerry Y.S. Lin is a Regents' Professor at Arizona State University. He served as Chair of the Chemical Engineering Department at ASU from 2006 to 2009, following a 13-year faculty appointment in Chemical Engineering at the University of Cincinnati. Dr. Lin's primary research interests include membrane science, adsorption/catalysis, and energy storage. He has authored approximately 400 peer-reviewed publications, primarily in chemical engineering journals, which have collectively garnered over 30,000 citations. Dr. Lin is the inventor or co-inventor of 16 issued and pending U.S. and European patents and is a co-founder of several startups aimed at commercializing inorganic membrane technologies for refinery stream separation and energy storage applications. He has received numerous honors, including the NSF Career Award (1995), the AIChE Institute Award for Excellence in Industrial Gas Technologies (2009), and the AIChE Gerhold Award (2021). Dr. Lin is an elected Fellow of the American Association for the Advancement of Science (AAAS), the American Institute of Chemical Engineers (AIChE), and the North American Membrane Society (NAMS). He currently serves as Co-Editor-in-Chief of the Journal of Membrane Science (JMS). He was also an Editor of JMS from 2008 to 2020 and was the founding Editor-in-Chief of JMS Letters.