UCLA ENGINEERING
Chemical and Biomolecular Engineering

SEMINARS IN CHEMICAL AND BIOMOLECULAR ENGINEERING

Friday, Oct 12th, 2018 | 10:00AM **Boelter Hall 3400**

Presented by:

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"New Amine-Based Membranes for H_2 Purification and CO_2 Capture"

This presentation covers new advances in amine-containing membranes for hydrogen purification for fuel cells and CO_2 capture from flue gas in coal- and/or natural gas-fired power plants and from <1% CO_2 concentration sources, e.g., the residual flue gas after the primary CO_2 capture system and coal-mine gas streams. We have synthesized highly CO_2-selective membranes comprising fixed-site and mobile carriers, involving the facilitated transport mechanism based on reversible CO_2 reactions with amine carriers. The membranes remove H_2S even faster than CO_2 (~3 times). In general, the membranes need to be tailor-made and tuned specifically for those applications. For example, hydrogen purification for fuel cells demands the membrane with a very high CO_2/H_2 selectivity of 100 along with a modest CO_2 permeance of about 100 GPU (1 GPU = 10^{-6} cm^3 (STP)/(cm^2 • s • cmHg)) or greater. On the other hand, post-combustion carbon capture requires a high CO_2/N_2 selectivity of 140 together with a very high CO_2 permeance of greater than 700 GPU in order to use a stand-alone membrane process. In order to achieve the membrane performance, highlighted are composite membranes comprising a high-selectivity layer on a highly permeable polymeric or inorganic/polymer support; the latter with zeolite nanoparticles can be used as the seed layer for continuous roll-to-roll fabrication of zeolite membranes. Also highlighted are the effects of amine steric hindrance, CO_2 concentration and SO_2 on membrane performance as well as the scale-up of the membranes through continuous roll-to-roll fabrication and spiral-wound membrane module testing with simulated and actual flue gas streams.

Dr. W.S. Winston Ho is a Distinguished Professor of Engineering in the William G. Lowrie Department of Chemical and Biomolecular Engineering and the Department of Materials Science and Engineering at The Ohio State University. Before teaching for 19 years, he had 28 years of industrial R&D experience in membranes and separation processes, working for Allied Chemical, Xerox and Exxon, and serving as Senior Vice-President of Technology at Commodore Separation Technologies. He was elected to the National Academy of Engineering, USA in 2002 in recognition of his distinguished contributions to engineering. A New Jersey Inventor of the Year (1991), Dr. Ho holds more than 55 U.S. patents, generally with foreign counterparts, in membranes and separation processes. He received the 2006 Institute Award for Excellence in Industrial Gases Technology from the American Institute of Chemical Engineers (AIChE), and he was the 2007 recipient of Clarence G. Gerhold Award, from the AIChE Separations Division, one of the highest honors bestowed to those working on separations. He received the 2012 Lawrence B. Evans Award in Chemical Engineering Practice from AIChE. In 2014, he was elected to Academia Sinica, the highest form of academic recognition in the Republic of China in Taiwan. He obtained his B.S. degree from National Taiwan University and his M.S. and Ph.D. degrees from the University of Illinois at Urbana-Champaign, all in Chemical Engineering.