Precision Separations Using Manufacturable Membrane Platforms: Opportunities in Aqueous and Non-Aqueous Filtration

As membrane scientists, we are always striving to precisely separate specific molecules amidst a veritable soup of many constituents in a liquid stream. Non-specific, or bulk, separations can lead to problems with fouling or contamination of the retained materials. This talk will describe challenges associated with precision separations in membranes, with a focus on aqueous and non-aqueous nanofiltration and reverse osmosis. We will review recent work by our lab describing the formation of manufacturable membrane materials and geometries to enable molecular selectivity in water and solvent systems. Topics to be covered include the fundamentals of thin film composite membrane formation and characterization, ceramic and composite membranes for solvent filtration, and additive manufacturing (i.e. “3D printing”) of membranes to enable new material use.

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Jeffrey McCutcheon is a Professor in the Chemical & Biomolecular Engineering Department at the University of Connecticut. He received a B.S. in Chemical Engineering from the University of Dayton and his Ph.D. in Chemical Engineering from Yale University. For nearly 20 years, he has pioneered work in membrane based separations technologies. He has raised over $10M to support research in the areas of forward osmosis, membrane distillation, nanofiltration, reverse osmosis, pervaporation, vapor permeation, organic solvent nanofiltration and additive manufacturing for membranes. He has published over 90refereed publications, written 3 book chapters, and has several patents on membrane technology. He has served the separations community as a Director for both the AIChE Separations Division and the North American Membrane Society (NAMS) and recently served as President of NAMS. He has received numerous awards including the 3M Nontenured Faculty Award, the Solvay Advanced Polymers Young Faculty Award, The DuPont Young Faculty Award, and the FRI/John G. Kunesh Award from the AIChE Separations Division. He recently was the winner of the 2019 Global Water Summit Water Technology Idol competition for his work on 3D printed membranes and was named a quarter- and semi-finalist of the American Made Challenges Solar Desalination Prize from the Department of Energy for his work on ceramic membranes for solar-driven membrane distillation. He was inducted into the Connecticut Academy of Science and Engineering in 2021. In 2017, he was named the Executive Director of Fraunhofer USA Center for Energy Innovation and served for 3 years before taking the Center to its now independent status as the Connecticut Center for Applied Separations Technologies (CCAST). CCAST is dedicated to applied research in the membrane technology and separations space and is charged to interact directly with industries in need of solutions to separations challenges.