

Covalent Organic Framework (COF) Membranes for Liquid Separations



Dr. Devin L. Shaffer

Assistant Professor

Department of Civil and Environmental Engineering

University of Houston

(Dr. Shaffer's lab website: <https://www.shafferlabgroup.com/>)

Abstract

Covalent organic frameworks (COFs) are ideal membrane materials because of their high-density of uniformly-sized nanopores and their controllable pore size and chemistry. As membranes, COFs could achieve challenging liquid separations that are important to the energy, environmental, and health fields. However, engineering nanoscale COF materials into functional membranes remains a challenge because of the difficulty of fabricating large-area COF films with vertically-aligned, single-digit nanopores and controlled thicknesses. This presentation will describe the synthesis and characterization of ultrathin imine-linked COF films composed of layered 2D COF nanosheets and fabricated by an interfacial polymerization process. Solvent fluxes through the COF membranes are predicted from COF structure by applying a continuum pore-flow model. The COF membranes are applied for desalination, organic solvent nanofiltration, and organic battery separator applications. The unique solute- and solvent-membrane interactions that impact these separations will be presented, and the implications for rational design of COF membranes will be discussed.

Speaker Biography

Dr. Devin L. Shaffer is an assistant professor of Civil and Environmental Engineering at the University of Houston. His research is focused on membrane separations, with an emphasis on membrane materials for water purification and resource recovery. Prior to joining to the University of Houston, he completed a post-doctoral research fellowship at the National Institute of Standards and Technology and earned his PhD in Environmental Engineering at Yale University.