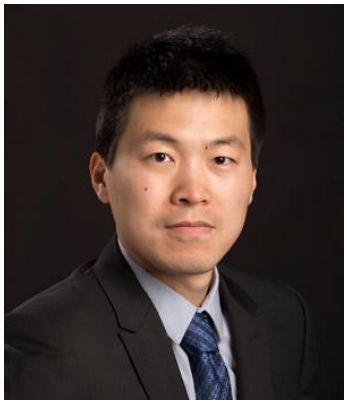
MARQUETTE UNIVERSITY

Departmental Colloquium
Electrical and Computer Engineering

Crystalline Microporous Membranes for PFAS Removal and Gas Separation

Tuesday, March 18, 2025
2:00 pm – 3:00 pm
Olin 125

Reception to follow
3:00 pm – 3:30 pm
Olin 204



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ABSTRACT: Membrane technology is an energy-efficient process that utilizes thin films as barriers to separate substances based on differences in molecular shape, charge, or chemical affinity. Incorporating microporous crystalline materials into membrane design can create ordered, uniform pore structures that enhance separation precision. This presentation will cover two applications of crystalline microporous membranes. The first topic addresses the pressing issue of water contamination by per- and polyfluoroalkyl substances (PFAS). Conventional reverse osmosis and nanofiltration membranes often reject high levels of minerals, resulting in low salt/PFAS selectivity. To overcome this limitation, we introduce continuous ionic covalent organic framework (COF) membranes that feature a highly negative surface charge and ordered pore channels with suitable pore sizes, leading to effective PFAS rejection with high salt/PFAS selectivity. The second part of the talk explores the potential of zeolitic imidazolate framework (ZIF) membranes for gas separations. ZIF nanocomposite membranes, produced through an all-vapor-phase process combining atomic layer deposition (ALD) with ligand-vapor treatment, exhibit a strong molecular sieving effect for separating similarly sized olefin/paraffin mixtures—a critical step for petrochemical processing.

BIOGRAPHY: Dr. Ma is an Associate Professor in the Department of Materials Science and Engineering at the University of Wisconsin-Milwaukee (UWM). He received his PhD degree from Arizona State University. His current research focuses on porous materials and membrane technologies for water treatment, desalination, and chemical separation applications. Dr. Ma received the Young Membrane Scientist Award from the North American Membrane Society, the ACS PRF Doctoral New Investigator Award, and the 2024 Lawrence E. Sivak '71 Faculty Fellowship from the College of Engineering and Applied Science at UWM.