Materials Engineering Program
Texas Center for Superconductivity at the University of Houston
Center for Integrated Bio and Nano Systems
10:00 am, Friday, December 1st, 2023

This seminar will be held in hybrid mode: in person at HSC 102

Selective CO_2 capture (and more!) using aluminum formate - a cheap, scalable, and robust next-generation ultramicroporous adsorbent

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Abstract: Gas separation, the act of sequestering one or more gasses from a mixture of gasses, has vital importance to many areas of society. Important separations include isolating CO_2 from combustion sources, purifying O_2 from air for medical purposes, or separating short-chain hydrocarbons from each other for chemical feedstocks. Recently, I and coworkers have shown that aluminum formate [$Al(HCOO)_3$, ALF] is an inexpensive material capable of excellent CO_2 adsorption and outstanding CO_2/N_2 selectivity at elevated temperatures (323 Kelvin). The work illustrated that ALF presents one of the most promising materials for tackling the megascale problem of CO_2 capture from fossil-fuel exhaust streams given its high performance above room temperature and aggressively low cost. However, our continued work on this material has uncovered that ALF is capable of much more than just CO_2 capture. The talk will discuss how ALF facilitates difficult gas separations/adsorptions with great efficiency and will discuss how the structure-property relationships of ALF are uniquely suited to these commercially and industrially relevant adsorption processes. The findings are supported by X-ray and neutron powder diffraction, gas-isotherms, gas breakthrough, Fourier-transform infrared spectroscopy, and thermogravimetric analysis. The variable temperature in-situ gas dosing X-ray and neutron powder diffraction experiments proved vital to understanding how the material interacts with the gasses of interest.

Bio: Hayden Evans obtained his PhD in Chemistry at the University of California Santa Barbara in 2018. In 2019, he joined the NIST Center for Neutron Research (NCNR) as a National Research Council (NRC) Postdoctoral Fellow and later became a staff Research Chemist there in 2021. His work uses neutrons, X-rays, as well as other advanced characterization techniques to study materials for future energy economy technologies (energy generation, storage, transport, and by-product remediation). His primary focus at NIST has centered on examining materials for gas sequestration and storage of gases, and solid-state electrolyte materials for batteries.