

Stephen Yaw Owusu

PhD Candidate

Department of Chemistry, Missouri S&T



Monday, 2 December 2024
4:00 pm in 303 Schrenk Hall

Tailoring selected aerogels to targeted applications

Abstract: Aerogels are extremely light porous solid materials with a three-dimensional nanostructured network. Due to their unique characteristics, they have attracted significant attention in the materials research community and were named among the top ten emerging technologies in Chemistry by IUPAC in 2022. Several diverse aerogels have been synthesized, yet a few of those have been associated with certain targeted applications. Tailoring and tuning the properties of the few known aerogels to improve their applications also present a significant challenge.

In this presentation, I will be discussing how some aerogels derived from isocyanate benzoxazine, benzodiazine, phenolic resin and metal oxide precursors have been tailored to targeted applications by tuning their properties including nanomorphology, pore volume, pore size, surface area and chemical composition. Specifically, tailoring morphologies of polyurea and poly(isocyanurate-urethane) aerogels improved their drug delivery properties. Tailoring the surface chemistry of polybenzoxazine and polybenzodiazine aerogels improved their applications as atmospheric water harvesters. Tailoring the chemical composition and pore size distribution of polyurea aerogels produced hard carbons with good electronic conductivity and a stable high capacity making them useful as anodes in sodium-ion batteries. Finally, to find applications for aerogels derived from metal oxides and phenolic resins as linear actuators in motors, a magnetic susceptibility gradient has been induced in the aerogels by tailoring their formulation strategies.