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National Institute of Standards and Technology (NIST)

Session 3: Renewable Energy

Talk Title: Microporous Water: Aqueous Fluids with High Gas Solubilities

Bio: Malia is currently a National Research Council Postdoctoral Fellow at the National Institute of Standards and Technology, where she uses neutron scattering techniques to study and improve carbon-capture materials. Prior to her postdoctoral work, Malia completed her Ph.D. in chemistry in 2022 at Harvard University with Jarad Mason. Her Ph.D. work focused on controlling gas absorption in liquids through manipulation of liquid structure and free volume. She previously graduated from Haverford College in Haverford, PA, where she majored in chemistry.

Talk Abstract: Liquids with permanent microporosity can absorb larger quantities of gas molecules than conventional solvents, providing new opportunities for liquid-phase gas storage, transport and reactivity. Current approaches to designing porous liquids rely on sterically bulky solvent molecules or surface ligands and, thus, are not amenable to many important solvents, including water. In this talk, I will summarize our development of a generalizable thermodynamic strategy to preserve permanent microporosity and impart high gas solubilities to liquid water. Specifically, we show how the external and internal surface chemistry of microporous zeolite and metal–organic framework (MOF) nanocrystals can be tailored to promote the formation of stable dispersions in water while maintaining dry networks of micropores that are accessible to gas molecules. As a result of their permanent microporosity, these aqueous fluids can concentrate gases, including oxygen (O_2) and carbon dioxide (CO_2), to much higher densities than are found in typical aqueous environments. This new class of microporous liquids could be leveraged for applications in oxygen delivery and transport or carbon capture and acid-gas separations.