

Troubleshooting a Zeolitic Imidazolate Framework Membrane for the Realization of Membrane Reactor-based Hydrogen Production

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Zeolitic imidazolate frameworks (ZIFs) have potential use in practical separations due to a flexible control over pore sizes, along with chemical and thermal stabilities. We first explored the effect of thermal treatments on the ZIF-7 structure, known for its promising characteristics toward H₂ separations (pore size of ~0.29 nm vs. kinetic diameter of H₂: 0.289 nm). In addition, the thermal stability of ZIF-8s, which are also known as molecular sieves (pore size: 0.34 nm) for H₂ separations, has been investigated under various heat-treatment conditions. The detailed procedure to ensure proper thermal activation will be addressed and further correlated with their intrinsic adsorption properties. Finally, ZIF-8 has been adopted to constitute continuous membranes. The resulting membranes were used to evaluate their H₂ perm-selectivities in an effort to check their compatibility in the membrane reactor configuration. The separation performance in favor of H₂ permeation rates through ZIF-8 membranes will be mainly discussed, while considering their reliable applications equipped with the long-term stability.