Characterization and Hydrothermal Stabilities of Supported Zeolitic imidazolat framework (ZIF-7) membranes

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Recently, hydrogen has been in the spotlight of a clean energy source that could solve the global climate change, energy depletion, air pollution. Accordingly, the necessity of thermally and hydrothermally stable membrane having a high hydrogen selectivity also stand out to produce hydrogen more efficiently and cost effectively. Thus, we investigated ZIF-7 membrane, which is a sub-category of metal-organic frameworks (MOFs), to separate hydrogen from other gases (CH4, CO, CO2). The thermal and hydrothermal stabilities as well as the structural degradation characteristics of supported ZIF-7 membrane were studied at various temperatures (423 – 673 K), H2O vapor concentrations (10 – 20 mol-%), and metal oxide supports (alumina, silica-alumina, silica, magnesia). By the hydrothermal stability test, The α-Al2O3 supported membrane was suffered from fatal hydrothermal degradation of the ZIF-7 membrane layer, and structural degradation was facilitated as temperature and H2O vapor concentration increased. Moreover, it was firstly found that the acid sites results in metal oxide supports markedly affect the hydrothermal stability of the ZIFs membranes.