Thermal-Structural Transitions and Carbon Dioxide Adsorp-tion Properties of Zeolitic Imidazolate Framework-7 (ZIF-7)

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As a subset of the metal organic frameworks (MOFs), zeolitic imidazolate frameworks (ZIFs) have potential use in practical separations due to a flexible yet reliable control over pore sizes, along with chemical and thermal stabilities. Among many ZIF materials, we explored the effect of thermal treatments on the ZIF-7 structure, known for its promising characteristics toward H2 separations; ZIF-7 pore sizes (0.29 nm) are desirable for molecular sieving, favoring H2 (0.289 nm) over CO2 (0.33 nm). The structural transition of ZIF-7 to an intermediate phase was observed under air as guest molecules were removed. The transition was further continued at higher temperatures eventually towards the zinc oxide phase. CO2 adsorption behaviors in three ZIF-7s with different shapes and sizes, albeit having identical pore structures, suggested minute differences in pore structures; particularly, smaller spherical ZIF-7 particles provided reversible CO2 adsorption isotherms at ~30-75 ℃, in contrast to the larger rhombic dodecahedral and rod-shaped ZIF-7 particles, which exhibited a hysteretic CO2 adsorption/desorption behavior.