Supporting Information

A Solid Solution Approach to 2D Coordination Polymers for CH$_4$/CO$_2$ and CH$_4$/C$_2$H$_6$ Gas Separation: Equilibrium and Kinetic Studies

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Experimental

[Zn(5NO$_2$-ip)(bpy)]$_n$ (CID-5, 5NO$_2$-ip = 5-nitroisophthalate), [Zn(5MeO-ip)(bpy)]$_n$ (CID-6, 5MeO-ip = 5-methoxyisophthalate), and their ligand-base solid solution compounds [Zn(5NO$_2$-ip)$_{1-x}$(5MeO-ip)$_x$(bpy)]$_n$ (CID-5/6, $x$ = 0.1, 0.2, 0.4) were synthesized according to reported procedures.$^1$ Characterization of these compounds was performed by powder X-ray diffraction data collected on a Rigaku RINT-2200HF (Ultima) diffractometer with CuK$_\alpha$ radiation and $^1$H NMR measured with a JEOL JNM-A 500 FT NMR system. Equilibrium gas adsorption and desorption isotherms were measured by a BEL HP instrument. All measurements were executed at 273 K, at a pressure range of 0.0~1.0 MPa and an equilibrium time for each pressure point was set for 500 seconds.

Breakthrough curve measurements were performed using a hand-made gas flowing system. Sample cell was filled with sample powders and temperatures of the cell were controlled by a refrigerant circulating system. For CH$_4$/CO$_2$ mixture gas, the gas fraction was CH$_4$:CO$_2$ = 60:40 (vol) and the measurements were executed at 0.80 MPa of total pressure at 273 K with a space velocity of 6 min$^{-1}$. The relative pressure of CO$_2$ was 0.32 MPa. For CH$_4$/C$_2$H$_6$, the gas fraction was CH$_4$:C$_2$H$_6$ = 90:10 (vol) and the measurements were executed at 0.80 MPa of total pressure at 273 K with a space velocity of 6 min$^{-1}$. The relative pressure of C$_2$H$_6$ was 0.08 MPa.