Adsorption equilibria and kinetics of CO_2, CH_4, and N_2 on zeolite 13X

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Adsorption equilibria and kinetics of carbon dioxide, methane, and nitrogen on zeolite 13X were studied at (293, 308, and 323) K and pressure up to 1 MPa. The experimental data were measured by a high pressure volumetric system. The physical properties of zeolite 13X were analyzed by nitrogen adsorption/desorption isotherms at 77 K with automatic volumetric sorption analyzer.

The preferential adsorption capacity of carbon dioxide on zeolite 13X was much higher than that of the other gases. Each experimental isotherm was correlated by the Langmuir and Langmuir-Freundlich (L-F) models, and the deviation of each model was evaluated. The L-F model showed smaller deviation than the Langmuir model. Isosteric enthalpy of each component were evaluated by using the L-F model and presented along with surface loading. Diffusion rates of each adsorptive on zeolite 13X were estimated from adsorption uptake curves by micropore diffusion model.

To minimize the simulation error in the design of adsorptive processes such as PSA, VPSA, TSA, etc., it was recommended to use the data within operating conditions of temperature, pressure and concentration.