Equilibrium and Kinetic H_2 Separation in Organic Templating Membrane by Molecular Properties

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Hydrogen separation on micro-porous methyltriethoxy- silane templating silica composite/α-alumina membrane (MTES membrane) was studied using six pure CO_2, CO, N_2, CH_4, He and H_2 gases , four binary mixtures - H_2/N_2, H_2/CO_2, H_2/CH_4, H_2/CO and one quaternary mixture - H_2/CH_4/CO/CO_2. The equilibirum and kinetic characteristics of an MTES membrane were studied using unsteady and steady-state permeation. The separation mechanisms could be primarily ascribed to the molecular size, and structure of each gas which likely contributed to steric hindrance or molecular sieving within the membrane pore. In addition, the adsorption affinity of each molecule on the membrane surface acted as a key factor in separation performance because it highly contributed to the surface diffusion. The generalized Maxwell-Stefan model incorporating the dust gas model and the Langmuir model could successfully predicted the transient and steady-state permeation/separation.