

PST-1: A Synthetic Small-Pore Zeolite that Selectively Adsorbs H₂

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The ability of zeolites to discriminate between molecules of different sizes and shapes has long been recognized. This ability legitimates their consideration as “Molecular Sieves” and has been the basis for many applications in catalysis and gas separation technologies. Some separation processes may also be based on specific host-guest interactions, rather than relying just on size or shape recognition. However, examples of selective adsorption of the smallest gases in zeolites are scarce.

Herein, we report on a synthetic potassium gallosilicate natrolite with Si/Ga=1.28 denoted PST-1 (POSTECH number 1), which can adsorb only the smallest gases (H₂, He, and H₂O with Lennard-Jones (L-J) sizes of 2.89, 2.60 and 2.65 Å, respectively), thus allowing discrimination from slightly larger molecules (Ar and CO₂ with L-J sizes of 3.40 and 3.30 Å, respectively). Furthermore, PST-1 is selective for H₂ over He, despite the smaller size of the latter. Because of the remarkable easiness of its dehydration and great thermal and hydrothermal stability, PST-1 could be a potential candidate for fast, selective H₂ or He separation processes based on PSA or membrane technology.