

Synthesis of all silica DDR zeolite particles and their CO₂, N₂ and H₂O adsorption properties

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All silica DDR (deca-dodecasil 3R) zeolite is a strong candidate for CO₂ (0.33 nm) separation from N₂ (0.364 nm) because its rigid pore structure with the size of 0.36 x 0.44 nm² allows for separations via the differences in their molecular sizes. We conducted two parameter studies of the variation of silica sources (TMOS, TEOS, fumed silica and silica sol) for non-seeded growth and of the seed amount for seeded growth. For the former, we obtained all silica DDR (Si-DDR) zeolite particles from various silica sources and these particles were further used for the subsequent seeded growth. It was found that Si-DDR zeolite particles (2~6 μm), obtained by seeded growth, were smaller than those obtained by non-seeded growth and showed mono-dispersed diamond shape. Variation of seed amount was effective for controlling the particle size of Si-DDR zeolites. Though the Si-DDR zeolites particles were synthesized by conducting the secondary growth of different seeded particles, seeded growth resulted in the comparable CO₂, N₂, and H₂O adsorption properties (~25, ~11-17 and 28-32 kJ•mol⁻¹, respectively).