Electronic supplementary information (ESI)

Amorphous nano-structured silicas for high-performance carbon dioxide confinement

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Contents

1. Additional experimental section

1.1. Raman spectroscopy

Raman spectra of adsorbed CO_2 were measured using an NRS-2100 spectrometer (JASCO) with a 514.5-nm laser (laser power 5 mW, exposure time 900 s × 2) and a resolution of 2 cm^{-1}. Indene under inert atmosphere or an artificial diamond[S1] (Tokyo Progress System, Raman shift 1332 cm^{-1}) was used for the wavenumber calibration. The spectra of CO_2-condined adsorbents were recorded under ambient conditions, while the measurement of solid CO_2 was performed at −170 °C with a cooled cell (Linkam, model THMS600/LK-600PM/L-600A).

1.2. Transmission electron microscopy (TEM)

TEM measurements were performed on a JEM-2010F (JEOL) equipped with a field emission gun (operated at 200 kV). The S-400 and S-800 samples were pretreared at 400 °C for 3 h in a stream of dry air (dew point ca. −40 °C) prior to the measurements.

1.3. N_2 and Ar adsorption measurements

Surface areas and pore structures were characterized by measuring the N_2 and Ar adsorption−desorption isotherms using a BELSORP-mini (BEL Japan) for N_2 and an Autosorb-1-MPa analyzer (Quantachrome) for Ar, respectively. Before the measurements, the samples were treated at 400 °C for 3 h in a stream of dry air (dew point ca. −40 °C), and subsequently at 120 °C for 3 h under N_2 flow on the BELSORP-mini apparatus and 200 °C for 3 h under vacuum ($<10^{-5}$ Pa) on the Quantachrome apparatus, respectively.

1.4. References

S1 S. A. Solin and A. K. Ramdas, *Phys*. *Rev*. *B*, 1970, **1**, 1687.

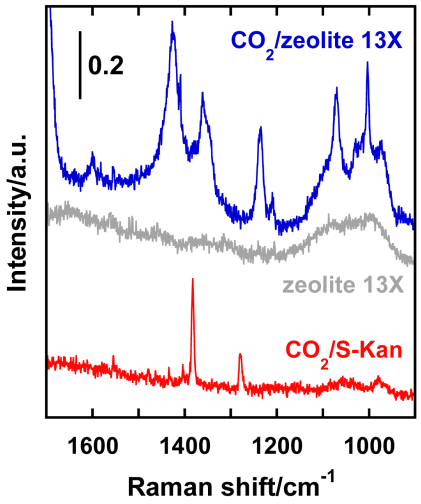

Fig. S1 Comparison of the Raman spectra of adsorbed CO_2 between S-Kan and zeolite 13X. For experimental details, see "**Notes and references** section§" and "**Additional experimental section** in ESI". Indene under inert atmosphere was used for the wavenumber calibration.

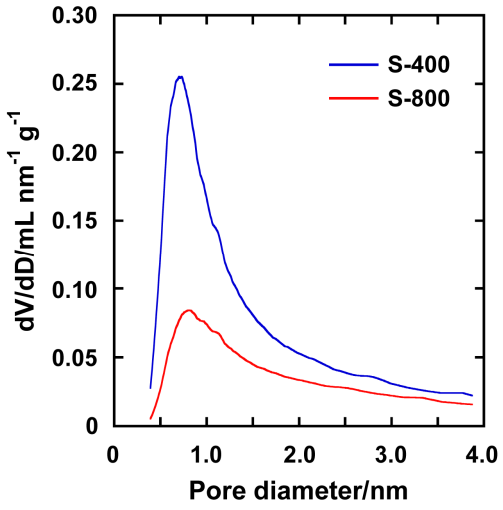

Fig. S2 Saito–Foley pore-size distributions of S-400 and S-800.

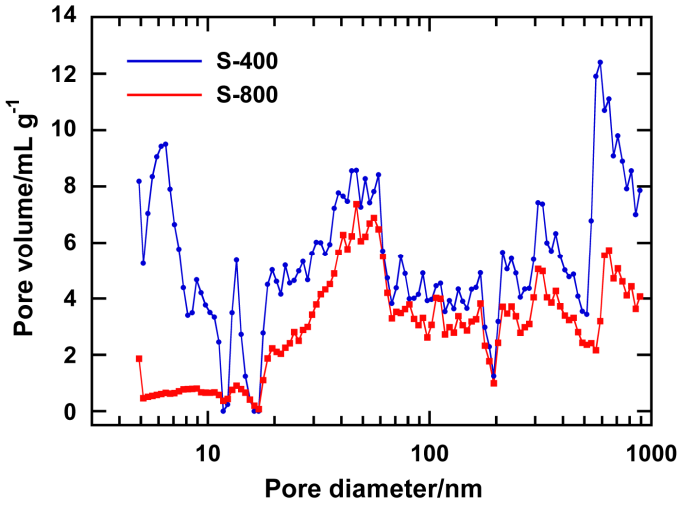

Fig. S3 Pore-size distributions of S-400 and S-800 determined by the non-local density functional theory (NL-DFT).

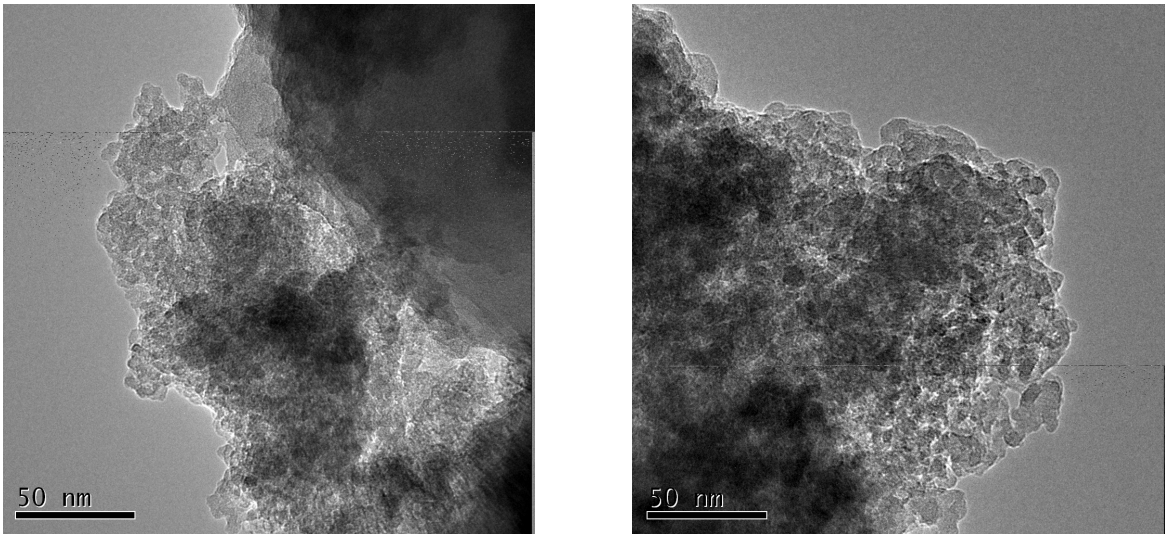

Fig. S4 TEM images of S-400 (left) and S-800 (right). Note that the mean first-order-particle size was larger for S-800 than for S-400 due to the difference in calcination temperature that determines the extent of sintering.