Dual-porous metal organic framework for the room temperature CO_2 fixation via cyclic carbonate synthesis

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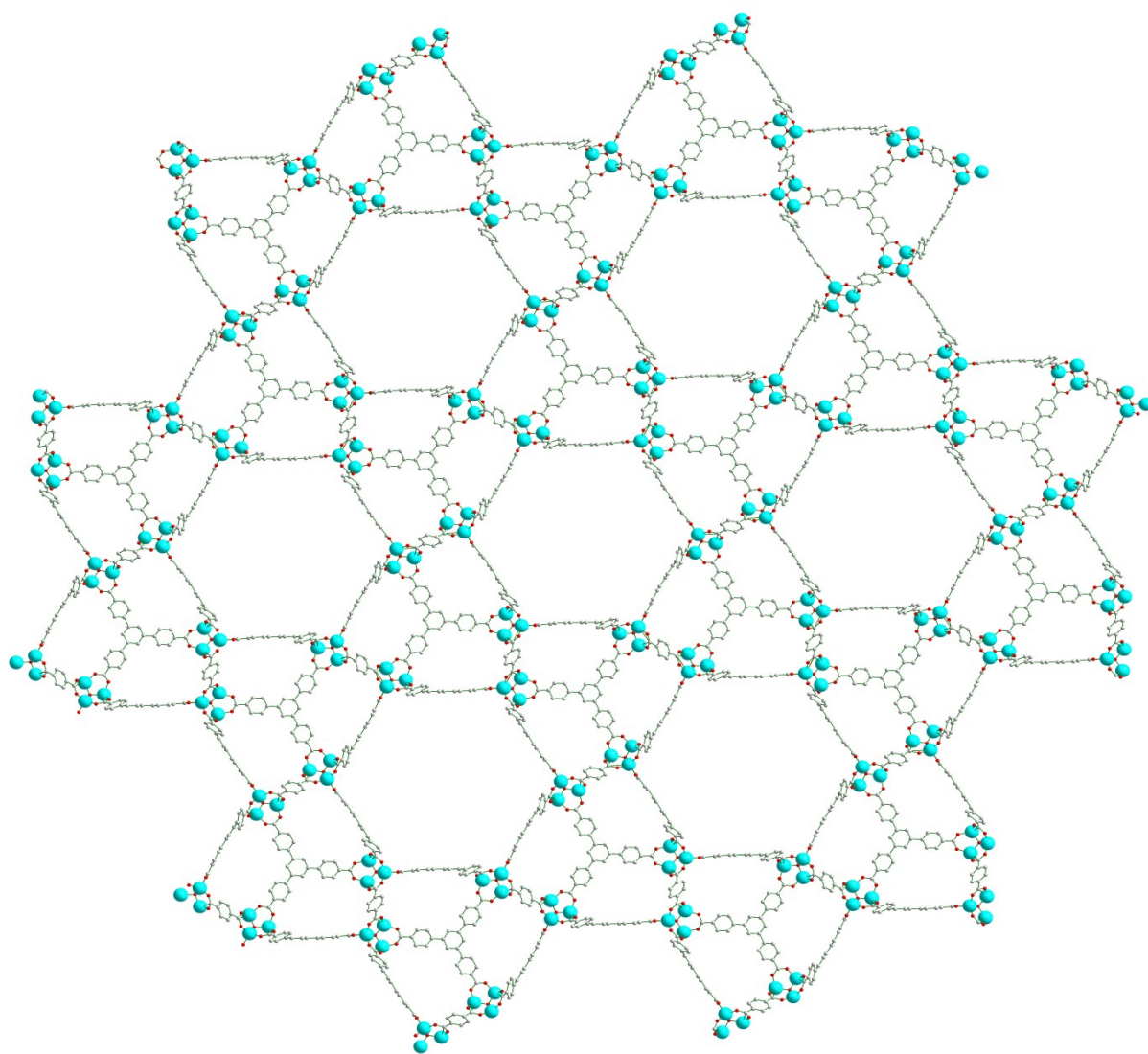
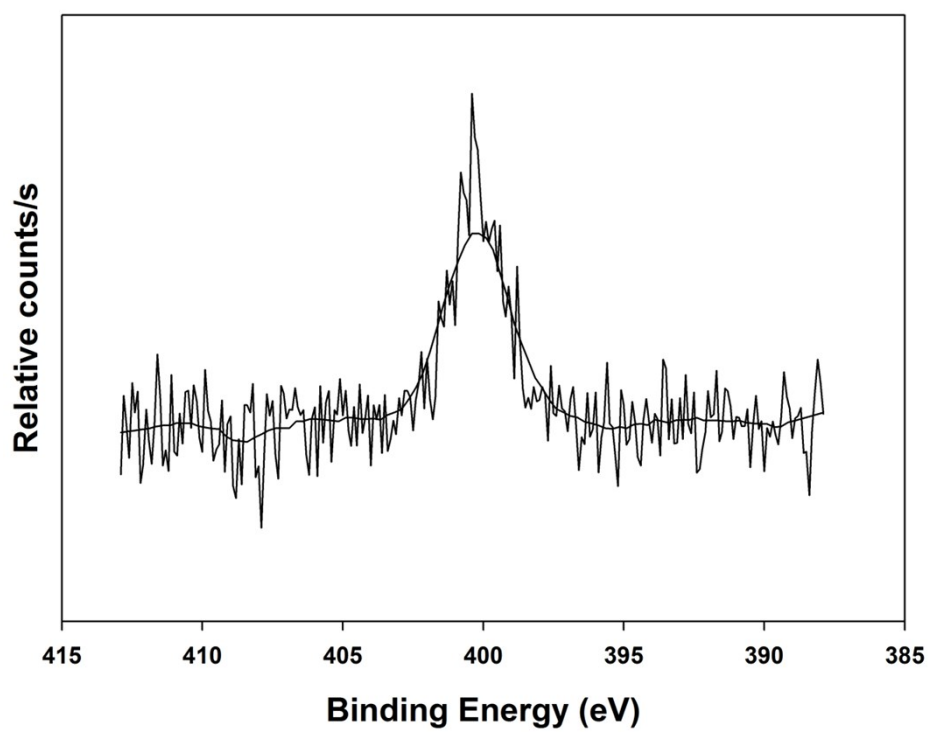Fig. S1. Arrangement of adjacent 1D hexagonal mesopores in UMCM-1-NH$_2$
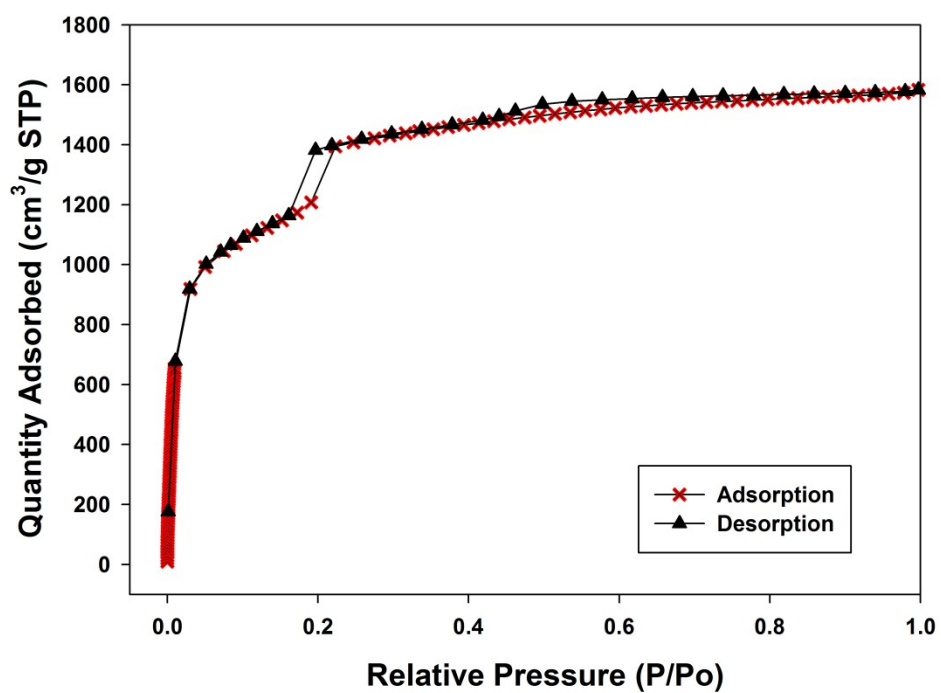
Fig. S2. XPS Spectra for UMCM-1-NH$_2$

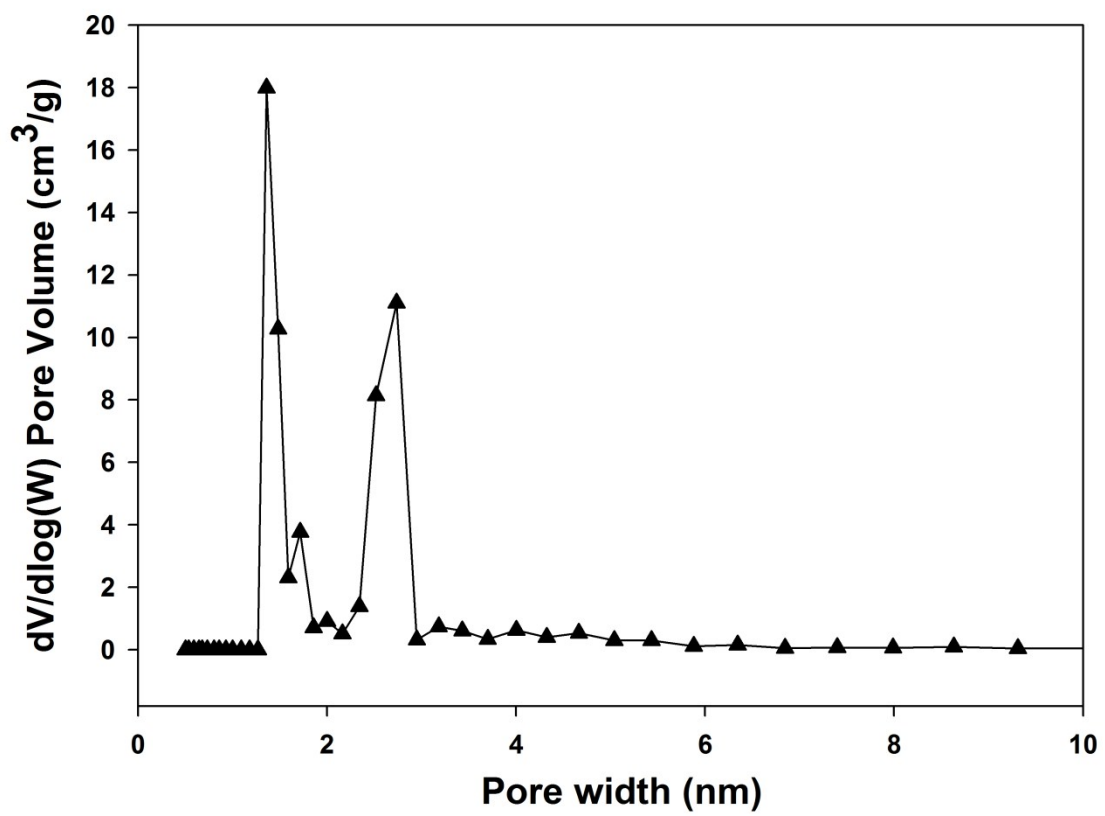Fig. S3. Nitrogen adsorption-desorption isotherm of UMCM-1-NH$_2$.

Fig. S4. Pore size distribution curve of UMCM-1-NH$_2$.

Instrumentation

The solvothermaly synthesized catalysts were characterized by X-ray diffraction (XRD), Brunauer-Emmett-Teller (BET) surface area, Fourier transform infra-red spectroscopy (FT-IR), elemental analysis (EA), inductively coupled plasma optical emission spectroscopy (ICP-OES), thermogravimetric analysis (TGA), and temperature programmed desorption (TPD). XRD patterns were recorded as powders in a Rigaku Ultima IV diffractometer using the CuKα radiation (40 kV, 40 mA). Step size D2θ = 0.02 °C, time per step = 4s. The diffractograms were recorded in the 2θ range 5°–55°. The textural properties of the catalyst were analyzed by recording an N_2 adsorption isotherm at 77 K with a BET apparatus (Micromeritics ASAP 2020). The specific surface area was determined using the BET model equation. FTIR spectra were obtained on an Avatar 370 Thermo Nicolet spectrophotometer at a resolution of 4 cm^{-1}. The elemental analysis (EA) of the catalysts was carried out using a Vario EL III analyzer. The metal contents of the catalysts were obtained from ICP-OES analysis using ULTIMA2 CHR (1.5 kW, 40.68 MHz, 130–800 mm) with mono chromato HDD and a poly chromato PMT detector. Thermogravimetric analysis (TGA) was conducted with an AutoTGA 2950 apparatus under a nitrogen flow of 100 mL min^{-1} while heating from room temperature to 600 °C at a rate of 10 °C min^{-1}. CO_2 and NH_3 TPD profiles were acquired with a chemisorption analyzer (BEL-CAT) as follows. Prior to measurements, 0.1 g of the sample was activated in He (30 mL min-1) at 280 °C for 1 h. The sample was subsequently exposed to the pulses of CO_2 (10%) or NH_3 (10%) in He at 40 °C for 1 h. The sample was then flushed with He (30 mL min^{-1}) for 1 h. TPD measurements were carried out by raising the temperature from 40 to 280 °C at a heating rate of 5 °C min^{-1}.