Electronic Supplementary Information

2D-Rectangular $c2mm$ Mesoporous Silica Nanoparticles with Tunable Elliptical Channels and Lattice Dimension

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Experimental details

Synthesis
Mesoporous silica nanoparticles were synthesized by injecting TEOS to the NaOH solution of mixed surfactants, and the injection rate was 18 mL h⁻¹. The molar composition of the synthesis mixture was \(8:f_n:(1-f_n):2.56:9840\) TEOS:C\(_{12}\)EO\(_4\):CTAB:NaOH:H\(_2\)O. The mixture was stirred at 35 °C for 24 h, further aged at 100 °C for 24 h, and finally was filtered and dried. The surfactants in the as-synthesized materials were removed by calcinations at 540 °C for 6 h. For the preparation of Pt-infiltrated MMT-1 sample, the mesoporous silica material synthesized with \(f_n=0.25\) (0.2 g) was impregnated with tetraammine platinum(II) nitrate (0.002 g) and was heated to 300 °C in a stream of oxygen. Additional amount of the same platinum precursor (0.32 g) was then impregnated, and the sample was then heated to 300°C in a stream of hydrogen to reduce the metal.

Characterization methods
PXRD data were obtained on a Mac Science 18MPX diffractometer using CuK\(\alpha\) radiation. Time-resolved SAXS measurements were tested and performed by using synchrotron X-ray (photon energy of 10.0 keV) on the beamlines 17B3 and 17A at NSRRC, Taiwan. Each reaction for the measurement was carried out in a batch reactor, and the reaction mixture was continuously pumped through a Kapton-sealed thin container, through which the X-ray beam passed, and then back to the reactor at a pumping rate of 40 mL/min. Both the reactor and the container were thermostated to a desired temperature of 35 °C. Gas physisorption isotherms were measured at 77 K using a Quantachrome Autosorb-1MP instrument. The pore diameter was evaluated by analyzing the reversible nitrogen sorption isotherms by nonlocal density functional theory (NLDFT) (by applying a N\(_2\)(77K) kernel based on cylindrical pore geometry). The surface area was calculated from the adsorption branches in the relative pressure range of 0.05-0.20 by the BET method, and the pore volume was evaluated at a relative pressure of 0.8. The SEM image was obtained with a JEOL JSM-7000F SEM operating at 200 kV. The TEM images were obtained using a JEOL JEM-2100F TEM (Cs=0.5mm, Point resolution 0.19nm) at 200 kV (Fig. 4b-e) and a JEOL JEM-2010 TEM at 200 kV (Fig. 4f).
### Table S1. Structural properties of calcined mesoporous silica materials

<table>
<thead>
<tr>
<th>$f_n$</th>
<th>Pore diameter[^a] (nm)</th>
<th>Surface area[^b] (m$^2$ g$^{-1}$)</th>
<th>Pore volume[^c] (cm$^3$ g$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3.9</td>
<td>1485</td>
<td>1.18</td>
</tr>
<tr>
<td>0.17</td>
<td>4.0</td>
<td>1183</td>
<td>0.98</td>
</tr>
<tr>
<td>0.25</td>
<td>4.0</td>
<td>1110</td>
<td>0.83</td>
</tr>
<tr>
<td>0.35</td>
<td>3.8</td>
<td>972</td>
<td>0.69</td>
</tr>
</tbody>
</table>

[^a]: Evaluated by analyzing the reversible nitrogen sorption isotherms by nonlocal density functional theory (NLDFT) (by applying a N$_2$(77K) kernel based on cylindrical pore geometry)

[^b]: Calculated from the adsorption branches in the relative pressure range of 0.05-0.20 by the BET method

[^c]: Evaluated at a relative pressure of 0.8
**Figure S1.** XRD patterns of the calcined mesoporous silica materials synthesized with different surfactant ratios.

**Figure S2.** SEM image of the pure-silica MMT-1 materials synthesized with $f_n=0.25$. 
Figure S3. Time-resolved SAXS patterns of the mesoporous silica synthesized with \( f_n = 0 \) (MCM-41).

Figure S4. Temporal evolution of the cell parameters \( a \) and \( b \) and the \( a/b \) ratio.