Supporting Information

Synthesis Mechanism of Cationic Surfactant Templating Mesoporous Silica under Acidic Synthesis Process

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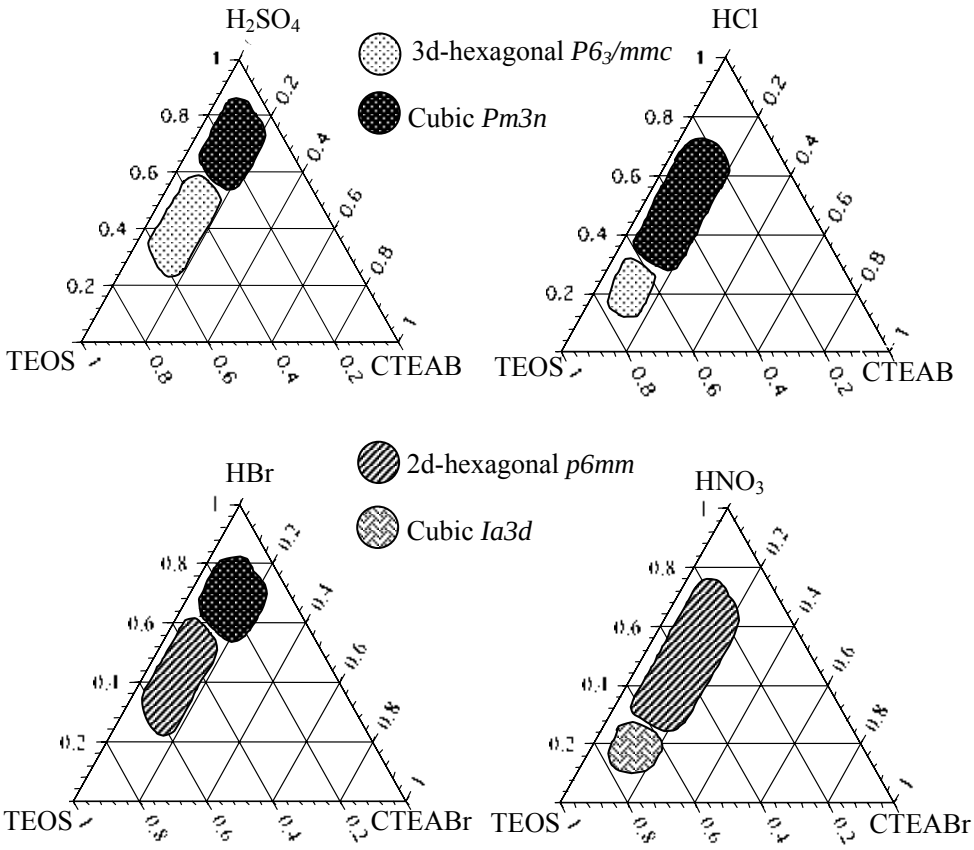

Figure S1. Synthesis-space diagram of mesophase structures established by XRD measurements. Each mixture had H_2O/Si molar ratio of 125. The mesoporous materials were synthesized under static condition at 0 °C for 1d.

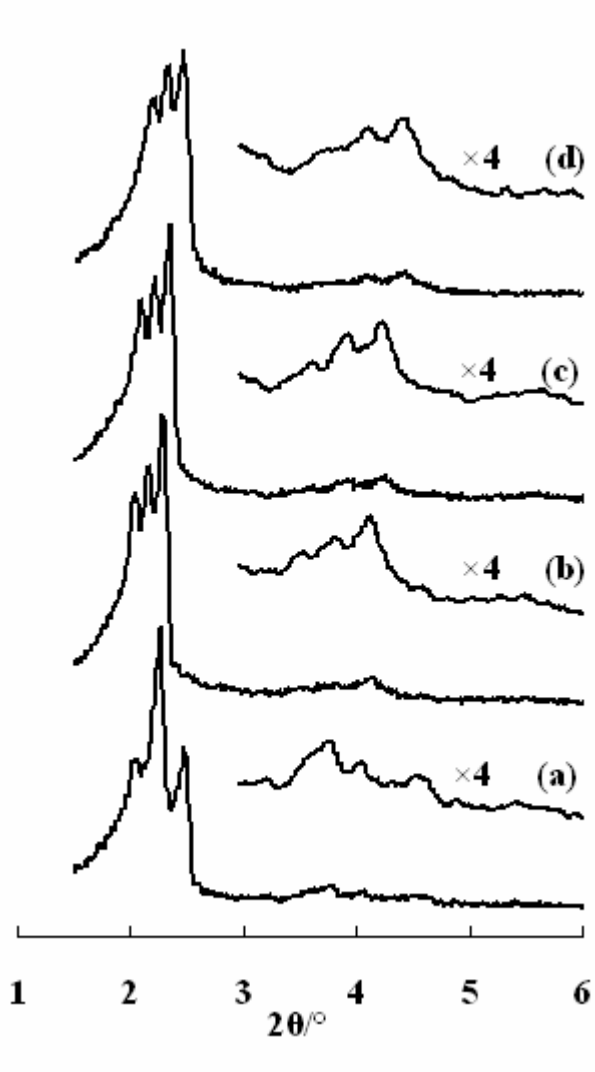

Figure S2 XRD patterns of the as-synthesized samples synthesized with various conditions shown in Table 1. TEOS/CTEABr (mol) = 13

Table 1. Mesostructures synthesized with different compositions.

Sample	Temperature (ºC)	H_2O/HCl (mol)	H_2O/TEOS (mol)	HCl/CTEABr (mol)	Product mesophases	Unit cell parameter (Å)
(a)	0	50	100	26	Cubic *Pm3n*	a = 86.9
(b)	30	50	100	26	3d-hexagnal $P6_3/mmc$	a = 47.4, c = 77.1, (c/a = 1.627)
(c)	0	70	100	19	3d-hexagnal $P6_3/mmc$	a = 49.7, c = 81.7, (c/a = 1.644)
(d)	0	50	50	13	3d-hexagnal $P6_3/mmc$	a = 46.7, c = 75.7, (c/a = 1.621)

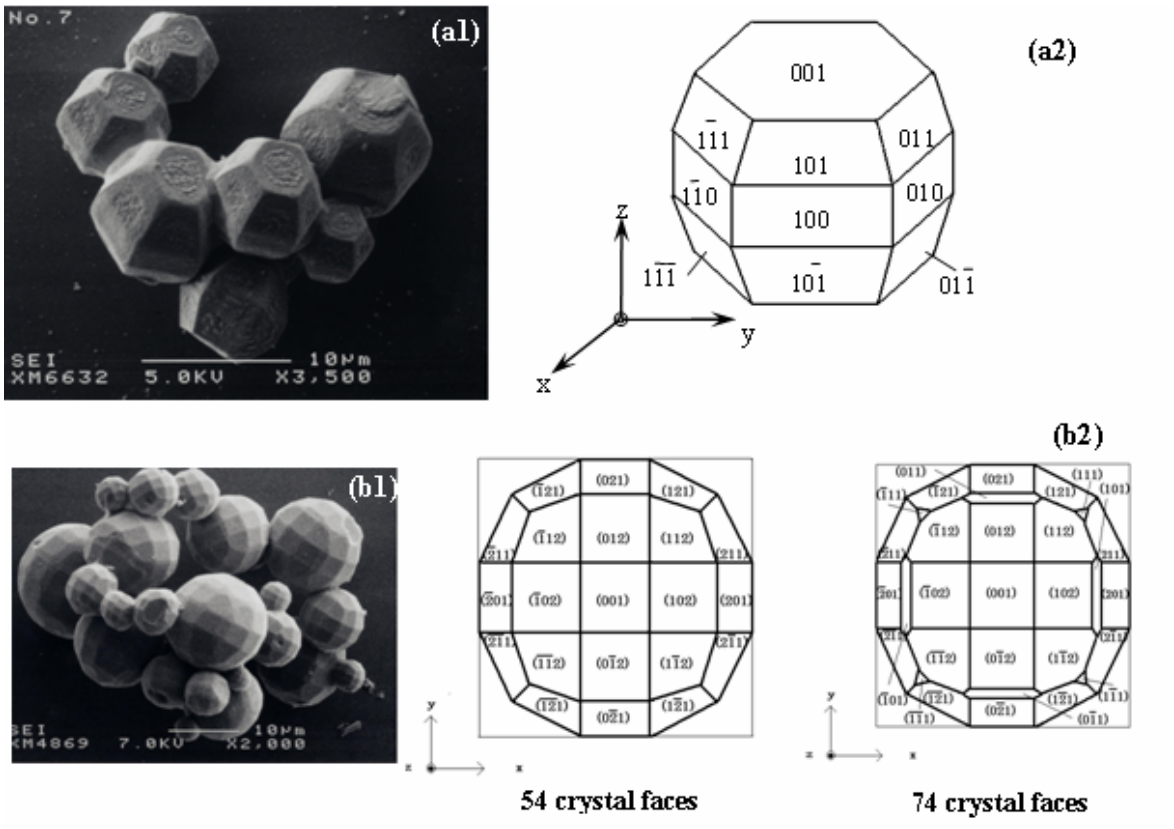

Figure S3. SEM images and surface indexes of the mesoporous materials synthesized with various acids. (a1) H_2SO_4, (a2) surface index of sample (a1), (b1) HCl, (b2) surface index of sample (b1).

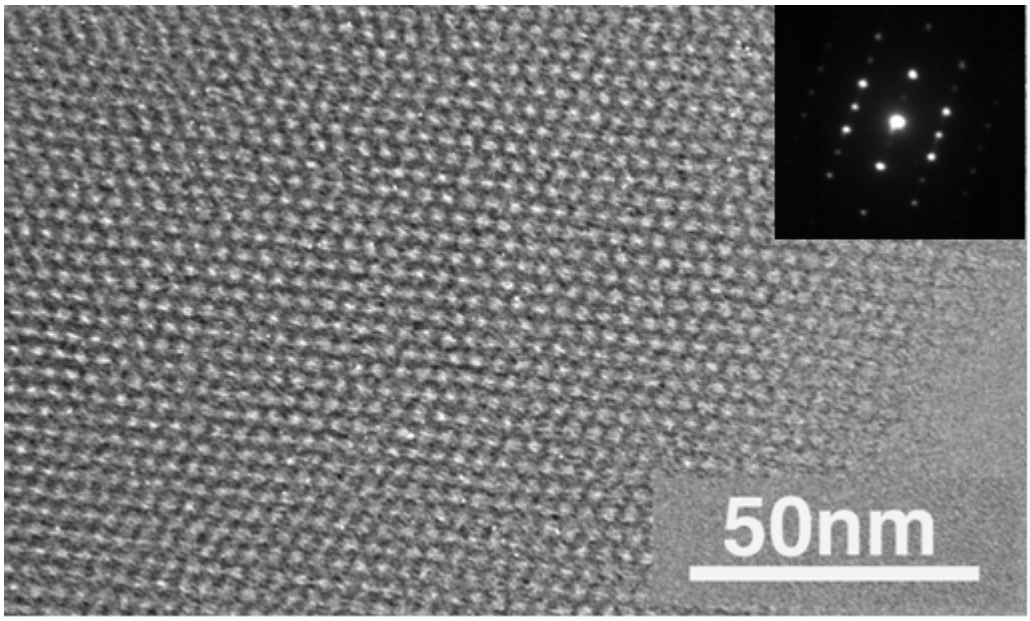

Figure S4. HREM images and Fourier diffractograms of the 3d-hexagonal *P*6$_3$/*mmc* mesophase synthesized with H_2SO_4.

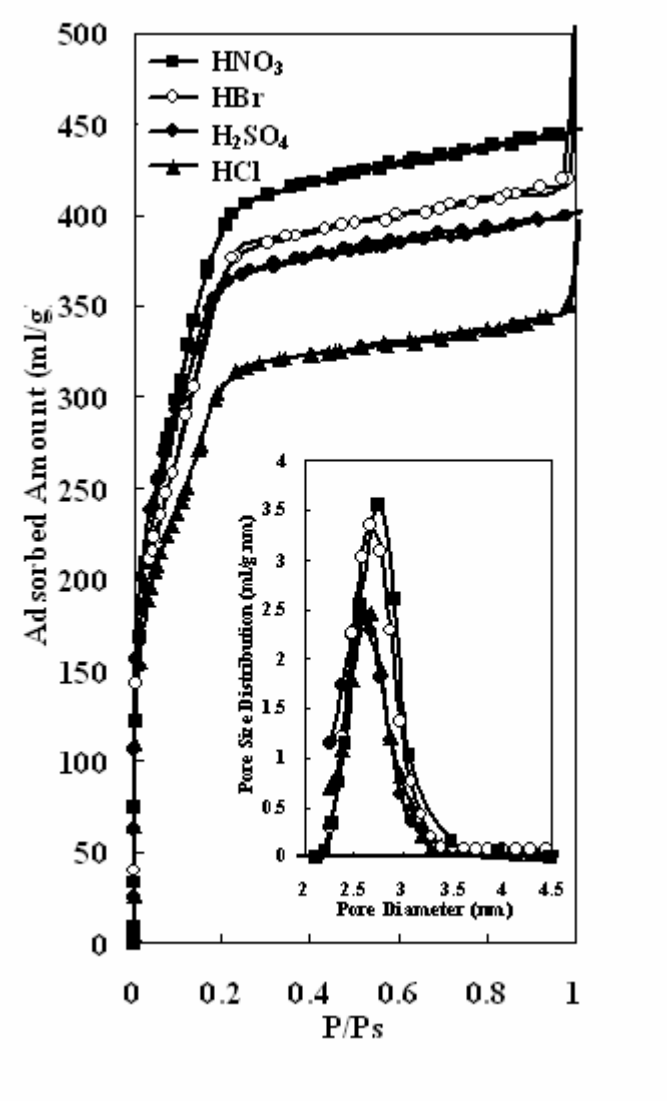

Figure S5. N_2 adsorption-desorption isotherms and pore size distributions of calcined mesoporous materials synthesized with different acids. Synthesis composition is the same to Figure S3 and 2.

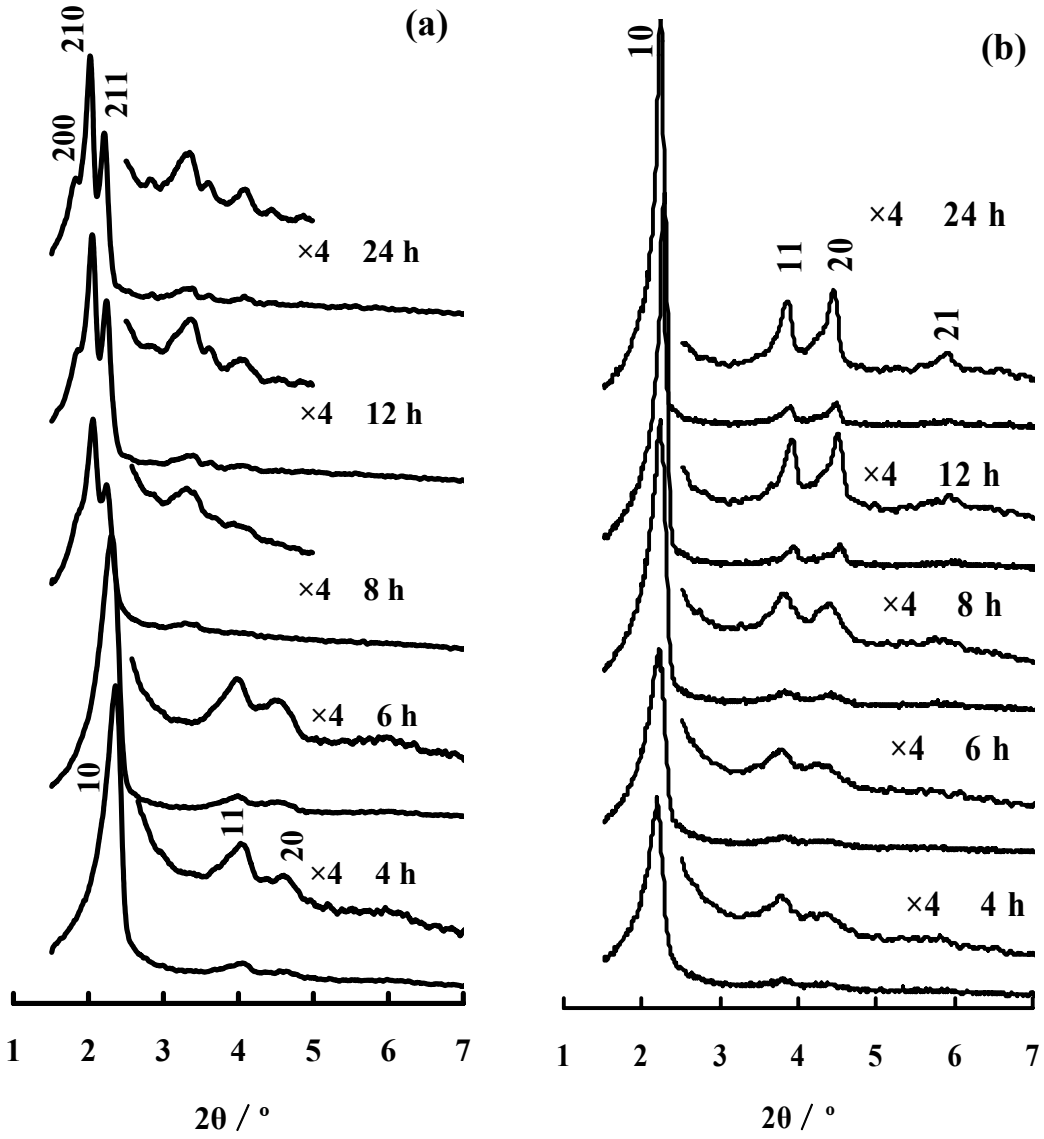

Figure S6. XRD patterns of as-synthesized materials synthesized by the addition of 1,2,4-TMB at 0 °C for various times.

Synthesis molar composition: 1: 0.13: 5: 125: x TEOS: CTEABr: HCl: H_2O: 1,2,4-TMB.

x = (a) 0.065 and (b) 0.130.

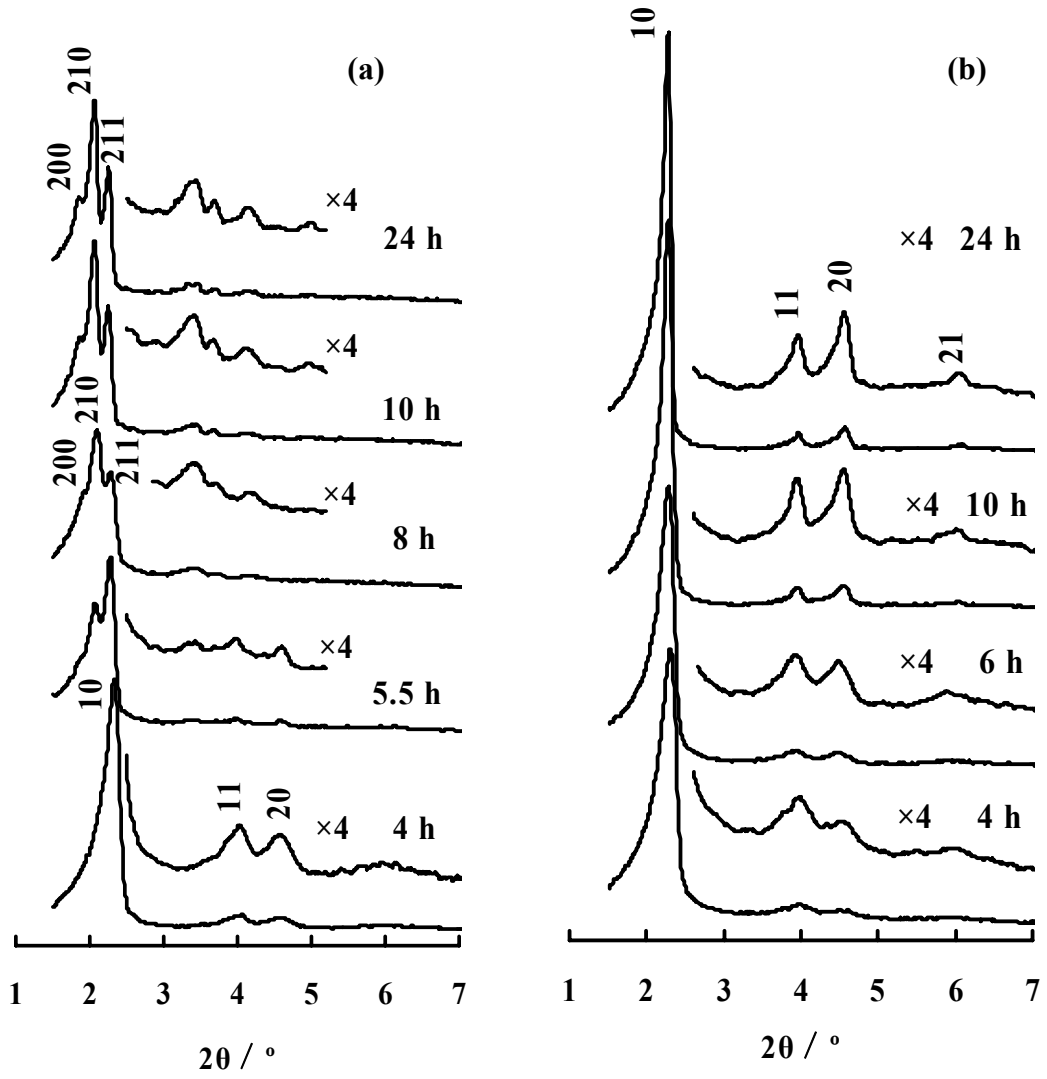

Figure S7. XRD patterns of as-synthesized materials synthesized with 1,2,3-TMB addition at 0 °C for various times.

Synthesis molar composition: 1:0.13:5:125:x TEOS: CTEABr: HCl: H_2O: 1,2,3-TMB.

x = (a) 0.039 and (b) 0.065.

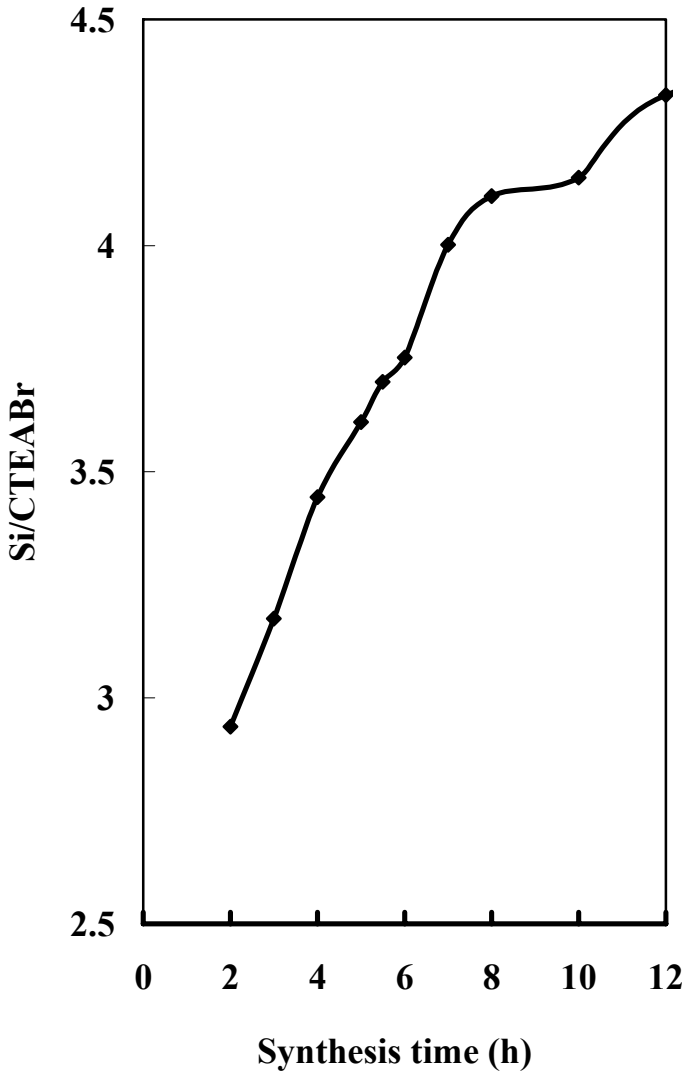

Figure S8. Si/CTEABr molar ratio of the products shown in Figure S7 (a).

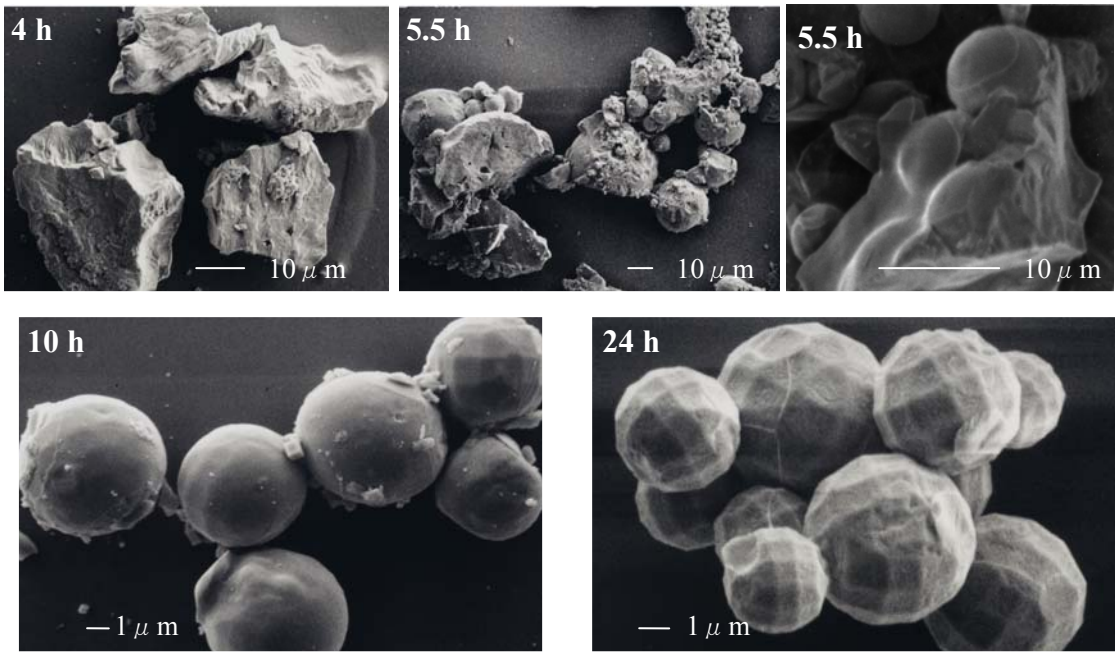

Figure S9. SEM images of the samples shown in Figure S7a.

Table 2. Properties of the four type mesoporous materials synthesized with different acids.

Sample[a]	Space group	Unit cell[b] (Å)	Surface area[c] S_{BET}/m^2g^{-1}	Pore volume[c] Vp/cm^3g^{-1}	Pore diameter[c] (Å)
H_2SO_4/CTEABr=35.0	3d-hexagonal $P6_3/mmc$	a = 49.473 (39.966) c = 80.978 (65.504) c/a = 1.637 (1.639)	1278	0.581	25.7
HCl/CTEABr=32.0	Cubic $Pm\bar{3}n$	a = 92.252 (82.233)	1024	0.510	27.0
HBr/CTEABr=19.2	2d-hexagonal $p6mm$	a = 52.782 (36.413)	1199	0.592	26.6
HNO_3/CTEABr=7.7	Cubic $Ia\bar{3}d$	a = 91.225 (69.745)	1396	0.794	27.2

[a] Samples synthesized with different acids at 0 ºC for 1 day. [b] The value inside brackets for unit cell parameter is the value for the materials calcined at 600 ºC for 6 h. [c] BET surface area, pore volume and pore size were determined from N_2 adsorption experiments.