Supporting Information

Hollow shell–corona microspheres with a mesoporous shell as potential microreactors for Au-catalyzed aerobic oxidation of alcohols

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1 Fourier Transform Infrared Spectroscopy (FTIR)

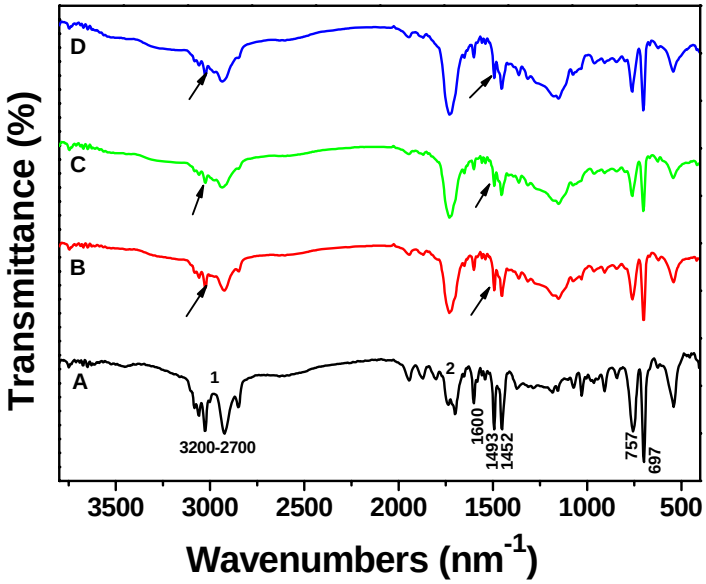

Figure S1. FTIR spectra of the core template of PS-*co*-PMAA microspheres (A), the coated microspheres of PS-*co*-PMAA/PS-*co*-PAEMA-*co*-PVTES-*co*-PMAA (B), the PS-*co*-PAEMA-*co*-PVTES-*co*-PMAA hollow microspheres (C), and the PS-*co*-PAEMA-*co*-PE-*co*-PMAA shell-corona hollow microspheres with mesoporous shell (D).

Figure S1 shows the FTIR spectra for tracking the synthesis of the PS-*co*-PAEMA-*co*-PE-*co*-PMAA shell-corona hollow microspheres with mesoporous

shell. Lines A, B, C and D are the spectra of the core template of PS-*co*-PMAA microspheres, the coated microspheres of PS-*co*-PMAA/PS-*co*-PAEMA-*co*-PVTES-*co*-PMAA, the PS-*co*-PAEMA-*co*-PVTES-*co*-PMAA hollow microspheres and the PS-*co*-PAEMA-*co*-PE-*co*-PMAA shell-corona hollow microspheres with mesoporous shell, respectively.

2 Effect of the toluene/water ratio on the oxidation of 1-phenylethanol within the microreactor.

Figure S2 shows the toluene effect on the aerobic oxidation of 1-phenylethanol within the microreactor of Au nanoparticles immobilized shell-corona hollow microspheres with mesoporous shell. It suggests that the suitable volume ratio of toluene/water is 2.0 mL/10.0 mL or 1/5.

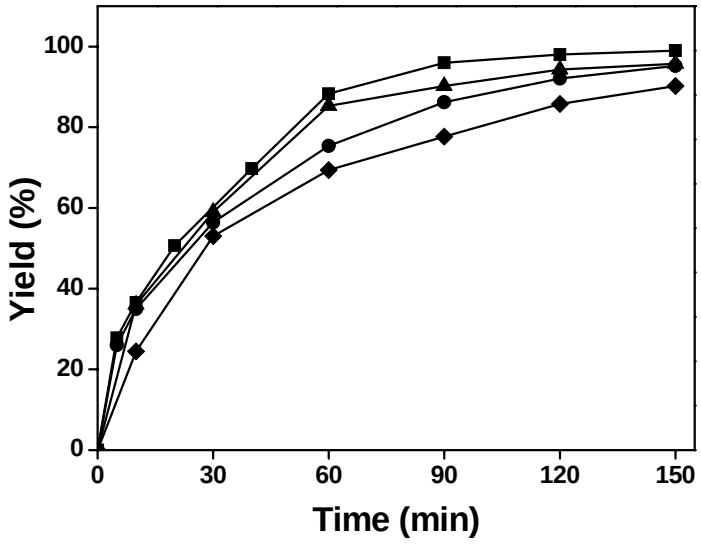

Figure S2. The time-dependence yield in the oxidation of 1-phenylethanol under toluene/aqueous biphase condition with different ratios of toluene/water: 1.0 mL/10.0 mL (▲), 2.0 mL/10.0 mL (■), 4.0 mL/10.0 mL (●) and 6.0 mL/10.0 mL (♦). Reaction condition: 10.0 mL of aqueous dispersion of the microreactor containing 5.0×10^{-3}

mmol of Au catalyst, KOH (0.168 g, 3.0 mmol), 1.0 mmol of 1-phenylethanol, a given volume of toluene, bubbling O_2 at 0.05 L/min, 80 ^{0}C, HPLC yield..

3 Base effect on the oxidation of 1-phenylethanol within the microreactor

Figure S3 shows the base effect on the aerobic oxidation of 1-phenylethanol within the microreactor of Au nanoparticles immobilized shell-corona hollow microspheres of PS-*co*-PAEMA-*co*-PE-*co*-PMAA. It suggests that KOH is the suitable base used for the aerobic oxidation of 1-phenylethanol.

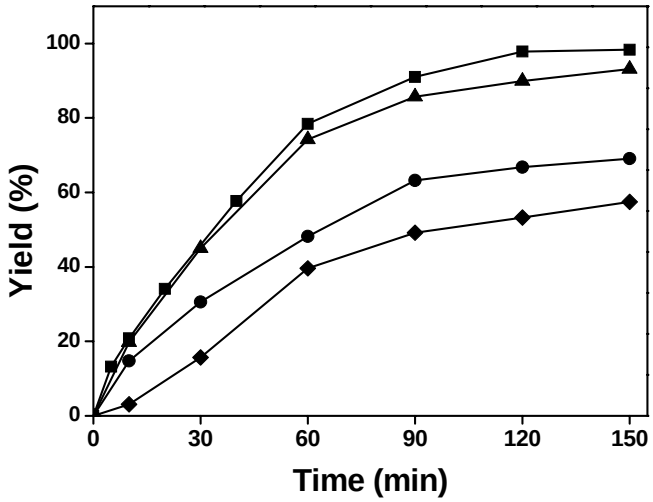

Figure S3. The time-dependence yield in the oxidation of 1-phenylethanol performed in aqueous solution with different alkali: KOH (■), NaOH (▲), K_2CO_3 (●) and NaAc (♦). Reaction condition: 10.0 mL of the aqueous dispersion of the microreactor containing 5.0×10^{-3} mmol of Au catalyst, base (3.0 mmol), 1.0 mmol of 1-phenylethanol, bubbling O_2 at 0.05 L/min, 80 ^{0}C, HPLC yield.

4. Synthesis of reference microreactor by immobilization of Au nanoparticles on the shell-corona hollow microspheres of PS-*co*-PAEMA-*co*-PAM

The shell-corona hollow microspheres of PS-*co*-PAEMA-*co*-PAM are synthesized as discussed in the reference (*Chem. Eur. J.* 2009, 15, 3670). The detail experiment on immobilization of Au nanoparticles is as similar as those discussed in the Experimental section. Figure S4 shows the reference microreactor of Au nanoparticles

immobilized shell-corona hollow microspheres of PS-*co*-PAEMA-*co*-PAM and the size distribution of the immobilized Au nanoparticles. The average size of the Au nanoparticles is 5.7 nm.

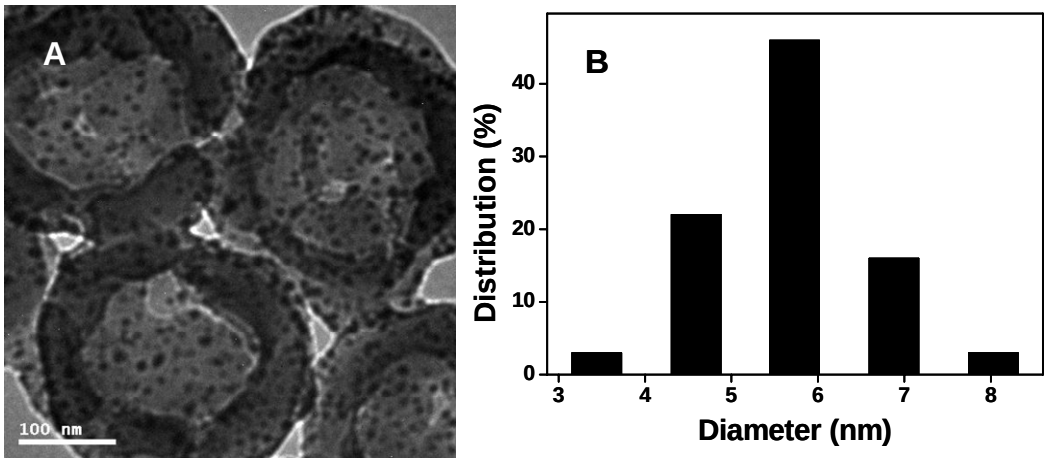

Figure S4. The TEM image of the reference microreactor of Au nanoparticles immobilized shell-corona hollow microspheres of PS-*co*-PAEMA-*co*-PAM hollow microspheres, which do not have a mesoporous shell (A) and the size distribution of the immobilized Au nanoparticles (B).

5. Stability of the PS-*co*-PAEMA-*co*-PE-*co*-PMAA shell-corona hollow microspheres with mesoporous shell

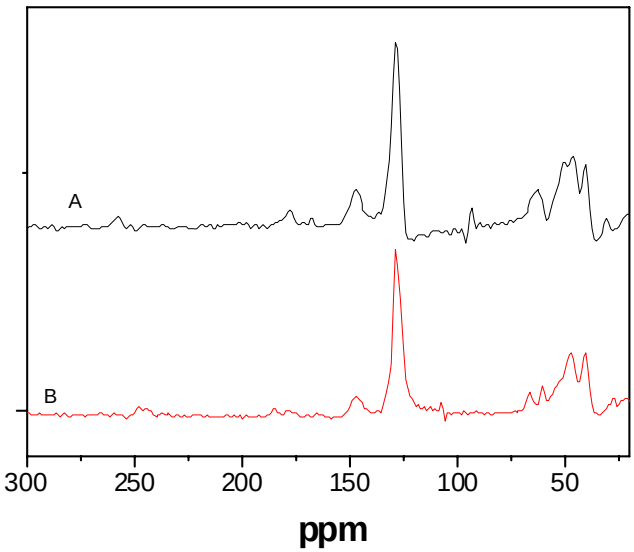

Figure S5. ^{13}C CPMAS NMR spectra of the fresh PS-*co*-PAEMA-*co*-PE-*co*-PMAA

shell-corona hollow microspheres with mesoporous shell (A) and those in the recycled microreactor.

Figure S5 shows the ^{13}C CPMAS NMR spectra of the fresh PS-*co*-PAEMA-*co*-PE-*co*-PMAA shell-corona hollow microspheres (A) and those in the recycled microreactor, which suggest that the hollow microspheres in the recycled microreactor have a similar composition with those of the fresh PS-*co*-PAEMA-*co*-PE-*co*-PMAA hollow microspheres.