Electronic Supplementary Material (ESI) for CrystEngComm.

Supporting Information

Magneto-acceleration of Ostwald Ripening in Hollow Fe_3O_4 Nanospheres

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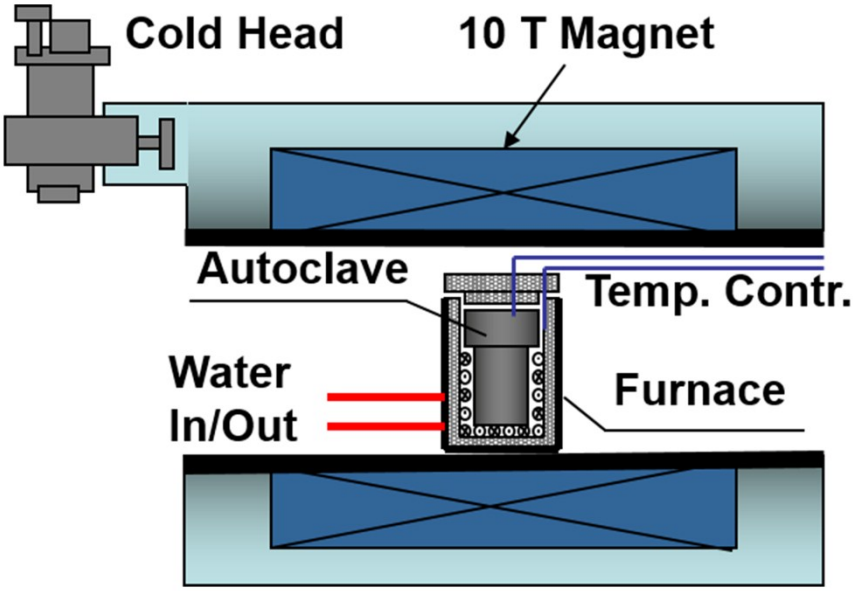
Synthesis of Fe_3O_4 nanospheres

Fe_3O_4 nanospheres were prepared by the solvothermal method. Briefly, a stoichiometric amount of $Fe(NO_3)_3.9H_2O$ (1.62g, 4 mmol) was dissolved in ethylene glycol (20 mL) to form a clear solution, followed by the addition of urea (0.72 g, 12 mmol). The mixture was stirred vigorously for 30 min and then sealed in a Teflon-lined stainless-steel autoclave (28 mL capacity). The autoclave was maintained at 210 ^oC for 10, 24, and 48 hours, respectively, and then cooled down to room temperature naturally. The black products were filtered and washed several times repeatedly with de-ionized water and absolute ethanol, and finally dried at 60 ^{o}Cover 24 hours in vacuum oven. The products are denoted by S10h-0T, S24h-0T, and S48h-0T, respectively.

Ostwald ripening of Fe_3O_4 nanospheres in magnetic fields

In order to study the Ostwald ripening of Fe_3O_4nanospheres under the magnetic field, magnetic fields of 0.5, 1, and 3 T was introduced respectivelyduring the reaction process with the same experimental conditions as S10h-0T, and these products were assigned as S10h-0.5T, S10h-1T and S10h-3T, respectively. The schematic illustration of experimental apparatus is shown in Scheme S1. A homogenous central magnetic field up to 10 T can be produced by a closed-cycled cryogen superconducting magnet with a bore diameter of 200 mm.The autoclave was put in the center of the magnetic field. The magnetic field was applied parallel to the axial direction and the temperature in the furnace chamber could be adjusted automatically by the controlling temperature system.[S1]



Scheme S1. The schematic illustration of experimental apparatus.

Material Characterization

Crystallographic analysis and crystallite size of the as-prepared products were determined by X-ray diffraction (XRD, X'Pert Pro MPD, Cu Kα radiation, λ=1.54056 Å). The XRD results are shown in Figure S1 and S2. The morphological and structural information of all the nanocomposites were obtained by field emission scanning electron microscopy (FE-SEM, FEI-designed Sirion 200, Hillsboro, OR), and transmission electron microscopy (TEM, JEM-2010, JEOL Ltd., Japan). The FE-SEM results are shown in Figure 1 in main text and Figure S3. The typical TEM results are shown in Figure 2 in main text. The porosity of the structures was determined with Barrett Joyner Halenda (BJH) methods with adsorption and desorption of nitrogen gas (Autosorb-iQ-Cx) and the results are shown in Figure 3 in main text. The magnetization of Fe_3O_4 nanospheres was measured on a Quantum Design superconducting quantum interference device (SQUID) system and the typical results are shown in Figure S4.

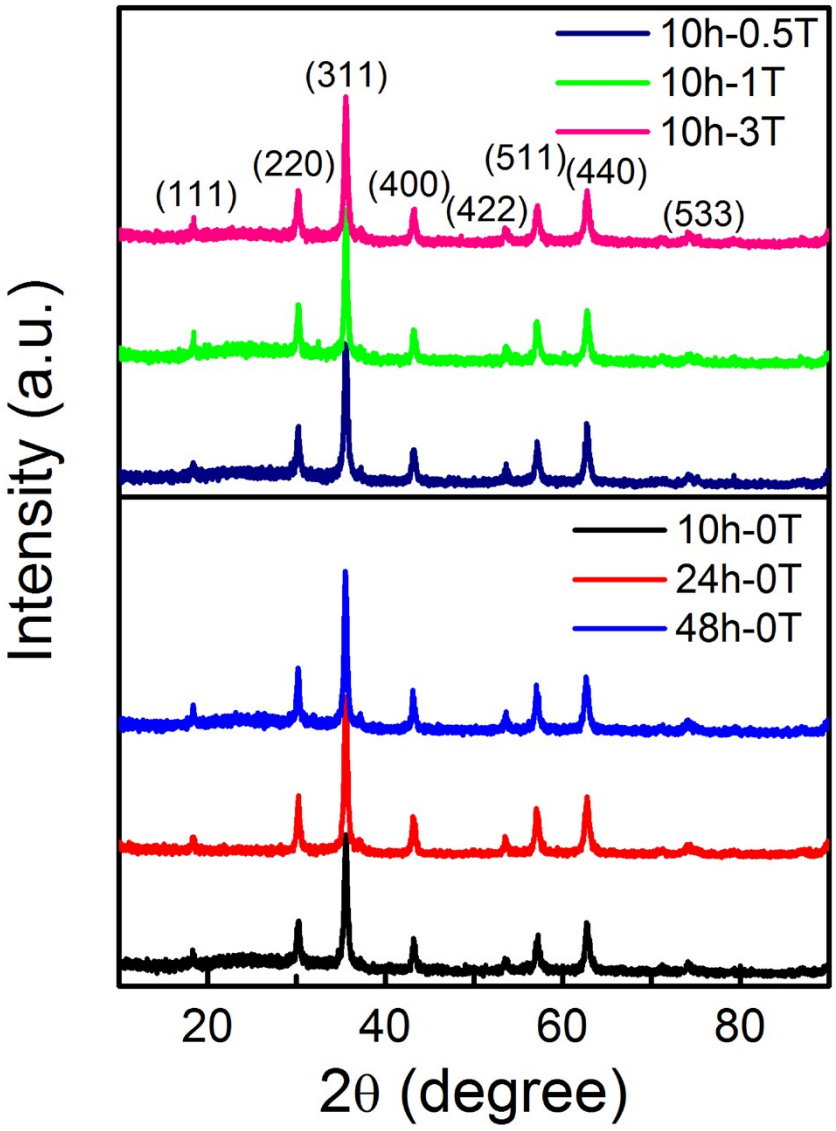


Figure S1. XRD patterns of the Fe_3O_4 nanospheres samples. All peaks are in good agreement with the standard JCPDS card of Fe_3O_4 (card no. 65-3107, a=b=c=8.390 Å), and no other phase is detectable.

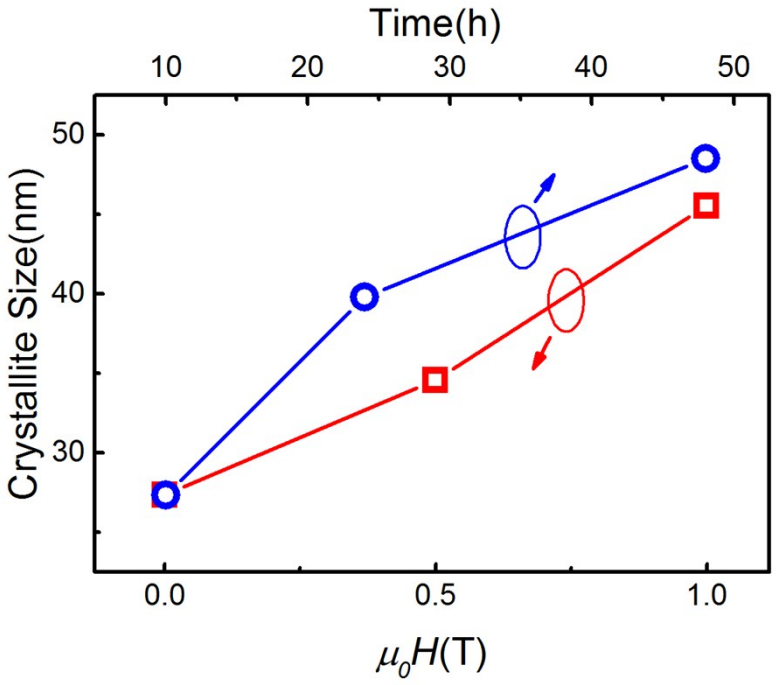


Figure S2. The variation in the derived crystallite size with maintaining time and magnetic fields, which are calculated from XRD results with the Wiliamson-Hall method. With increase of maintaining time from 10 to 24 and 48h, the crystallite size of the mesoporous Fe_3O_4 spheres increases monotonously from 27.4 to 39.8 and 48.5 nm, respectively. This is the typical feature of Ostwald ripening. Similar to the maintaining time, the external magnetic field can also enlarge the crystallite size of the mesoporous Fe_3O_4 spheres monotonously.

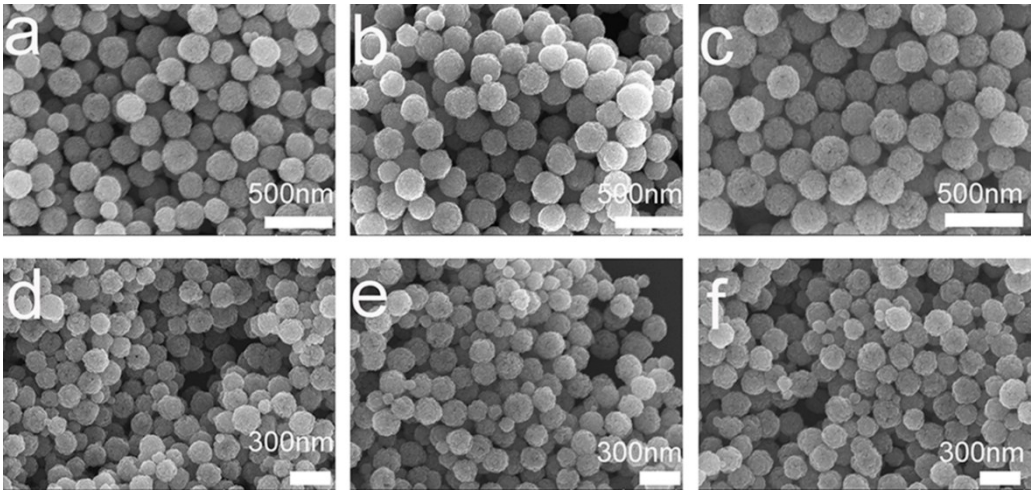


Figure S3. SEM images of: S10h-0T (a); S24h-0T (b); S48h-0T (c); S10h-0.5T (d); S10h-1T (e); S10h-3T (f).

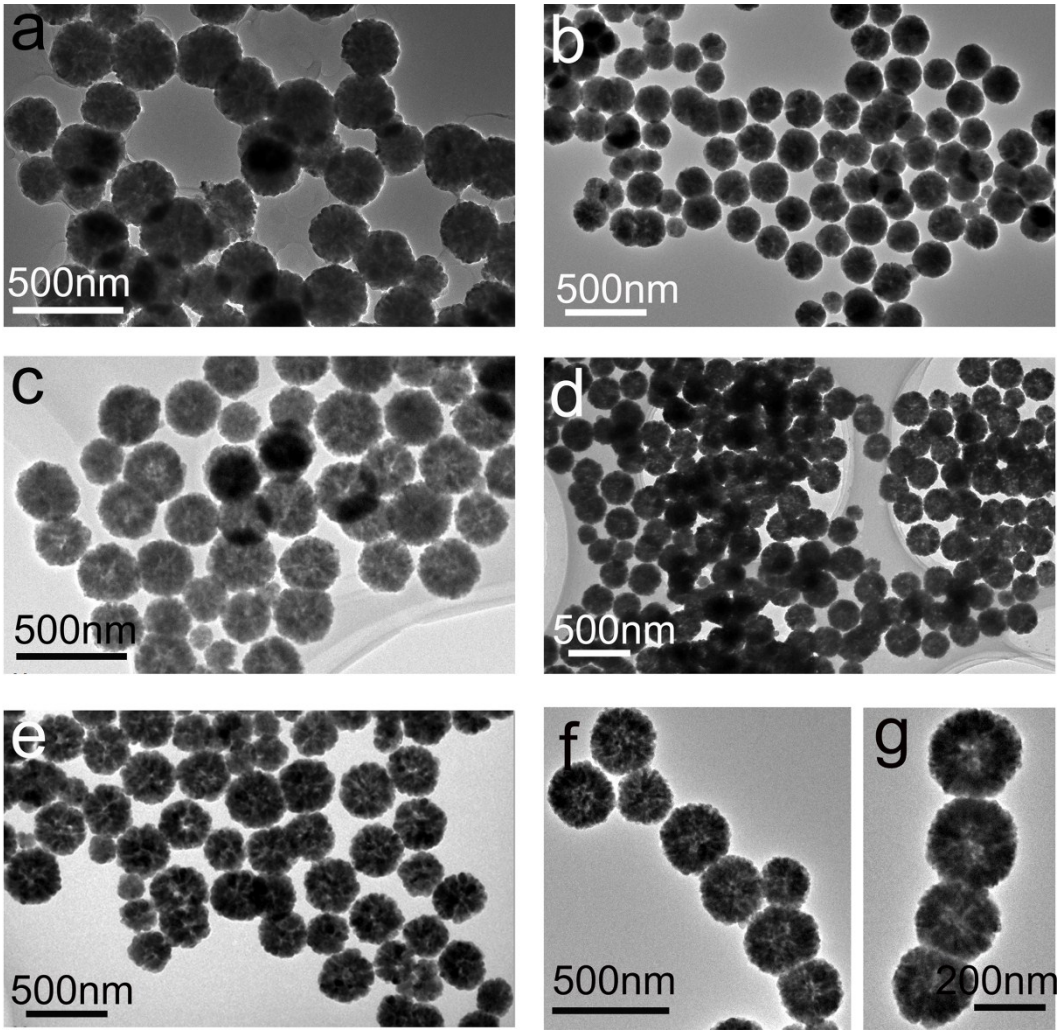


Figure S4. TEM images of: S10h-0T (a); S24h-0T (b); S48h-0T (c); S10h-0.5T (d); S10h-1T (e); S10h-3T (f)(g).

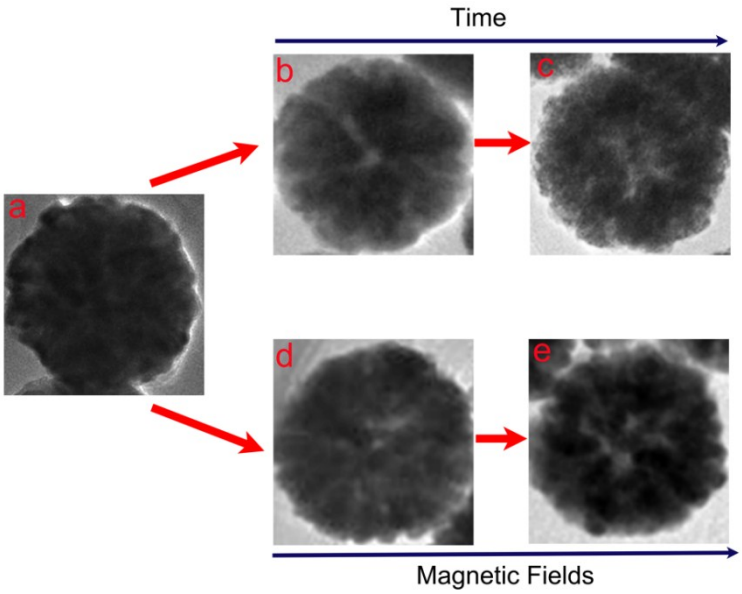


Figure S5 Magnified TEM images of S10h-0T (a); S24h-0T (b); S48h-0T (c);S10h-0.5T (d); S10h-1T (e)

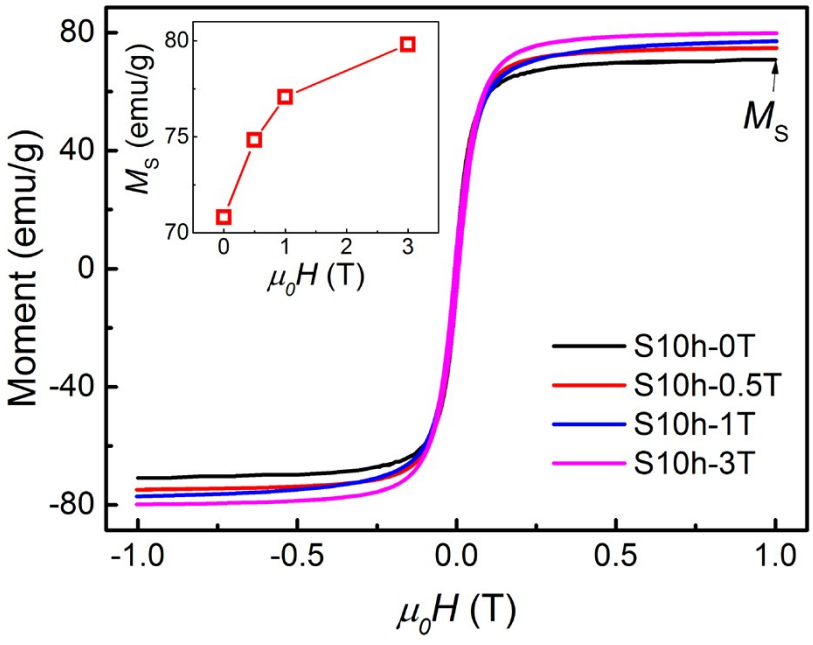


Figure S6. Magnetization as function of magnetic field for S10h-0T, S10h-0.5T, S10h-1T, S10h-3T samples, respectively. It is found the saturation magnetization (M_S) of Fe_3O_4 nanospheres increases monotonically with the applied magnetic fields.

Reference

S1. Zhang, K. J.; Dai, J. M.; Wu, W. B.; Zhang, P.; Zuo, X. Z.; Zhou, S.; Zhu, X. B. Sheng, Z. G.; Liang, C.H.; Sun, Y. P. Rev. Sci. Instrum. 2015, 86, 095105.