Supporting information

Surfactant-Assisted One-pot Synthesis of Superparamagnetic Magnetite Nanoparticle Clusters with a Tunable Cluster Size and Sensitivity for Magnetic Field

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Characterization of Fe_3O_4 nanoparticle cluster with FTIR method.

The XRD pattern of the maghemite (g-Fe_2O_3) and magnetite (Fe_3O_4) are very close. Therefore, to obtain additional data for characterization of spinel type iron oxide, the sample was measured by FT-IR spectrum.

Figure S1 show the FT-IR spectra of γ-Fe_2O_3 (Nanostructured & Amorphous Maerials, Inc. US), Fe_3O_4 (Kanto Chemical Co., Inc, Japan), these are used as references, and synthesizd iron oxide nanoparticle cluster with a diameter of 200 nm. The IR spectrum of the γ-Fe_2O_3 the broad bands at 698, 638, 580, and 562 cm^{-1} can be seen (Fig. S1 (a)). These are assigned as Fe-O bond of γ-Fe_2O_3.[1] In the FT-TIR spectrum of Fe_3O_4, one broad peak at 578 cm^{-1} can be seen and this band is assigned as Fe-O band of Fe_3O_4 (Fig. S1 (b)).[1] The IR-spectrum of the sample with a diameter of 200 nm also has broad peak at 578 cm^{-1} and no additional peaks (Fig. S1 (c)). This result strongly supposed to assignment of the synthesized iron oxide nanoparticle cluster as Fe_3O_4.

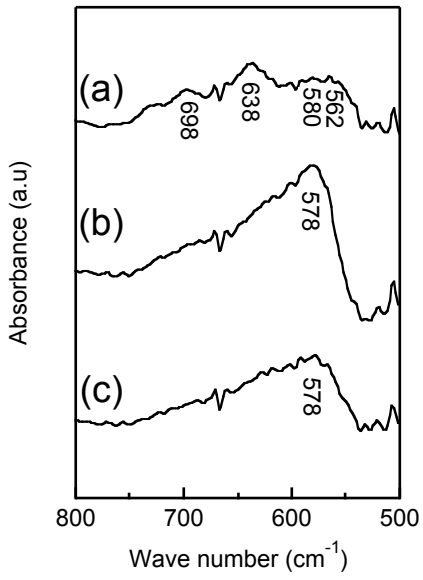


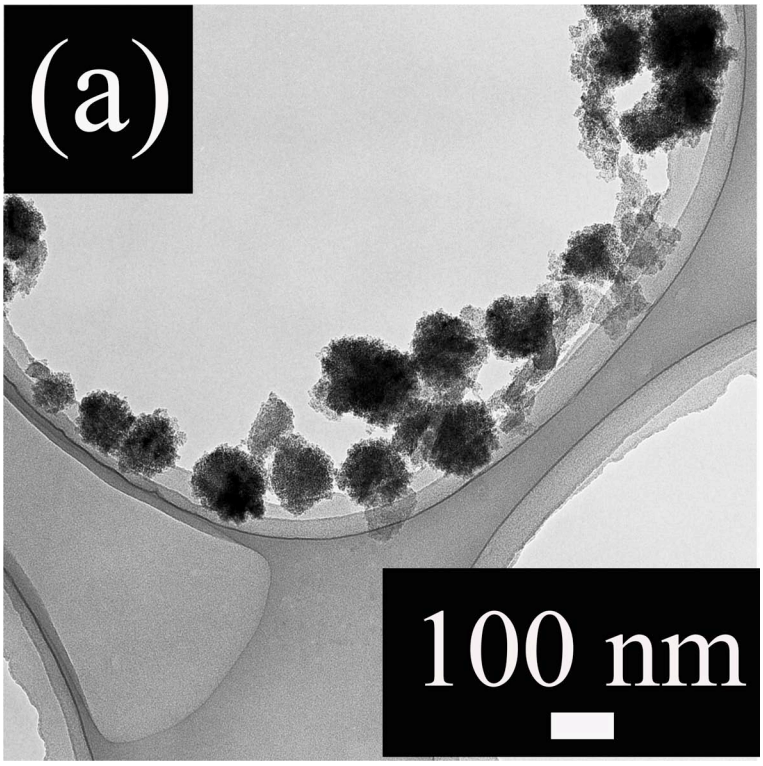
Figure S1. IT-IR spectrum of (a) γ-Fe_2O_3, (b) Fe_3O_4, and (c) synthesiszed Fe_3O_4 nanoparticle cluster with a diameter of 200 nm

Reference

[1] R.M. Cornell, U. Schwertmann, in *Iron Oxides* 2nd ed. 2003, pp 146.

High resolution TEM image of the Fe_3O_4 nanoparticle cluster

To confirm that the products were composed of tiny nanoparticle, the products were observed by HRTEM (Figure 2S). Figure 2S (a) and (b) were bright field image and dark field image of the products with a reaction time of 30 min. In dark field image, tiny bright spots were observed in bigger particle (Figure 2S (a), (b)). This indicates that the products were not single crystal and but consist of tiny Fe_3O_4 particle. Figure 2S (c) is a high-resolution image of the products. Clear lattice fringe can be seen in HRTEM image, this indicates the products have good crystallinity and were not amorphous. Measured distance between two adjacent planes in a specific direction gives a value of about 0.3 nm, which corresponds to the lattice spacing of 111 planes (0.487 nm) and 022 planes (0.297 nm), respectively, of magnetite.



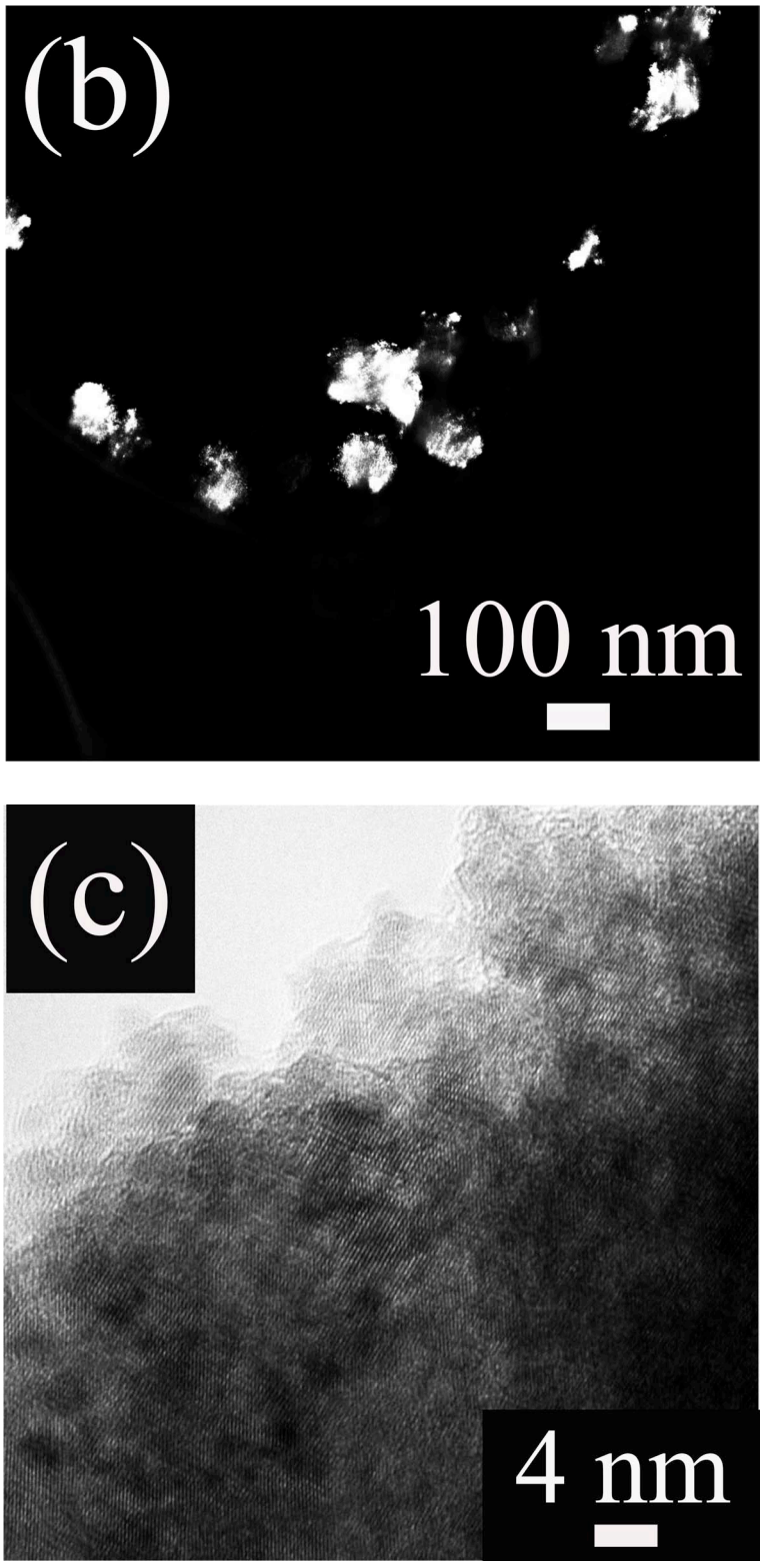


Figure 2S. TEM image of the products with a reaction time of a 30 min: (a) bright-field image, (b) dark-field image, and (c) high-resolution TEM image.