Electronic Supplementary Information

Solid-State Phase Transformation Mechanism for Formation of Magnetic Multi-Granule Nanoclusters

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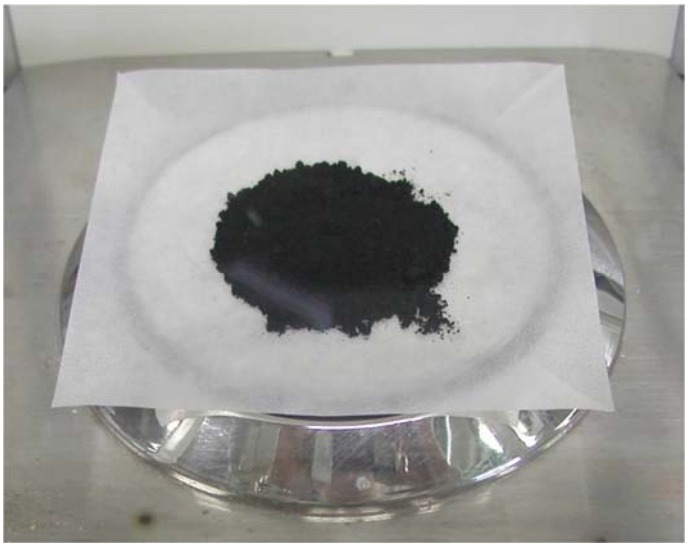

Fig. S1 Synthesized magnetic MGNCs (7.5 g) from 1.5 L scale one-pot reaction.

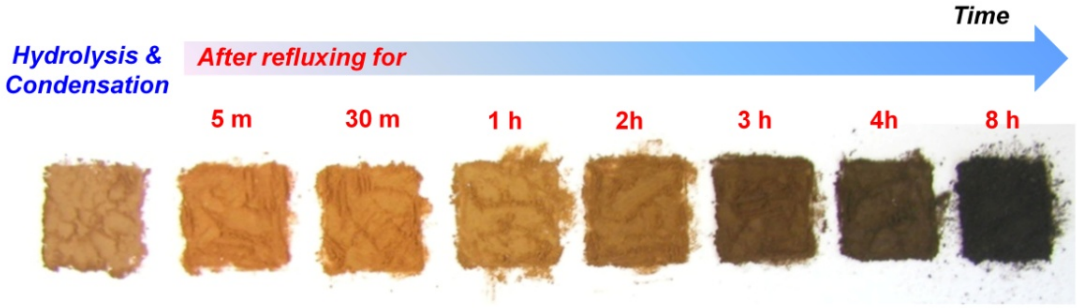

Fig. S2 Photograph of isolated powders of iron oxides at different reaction times.

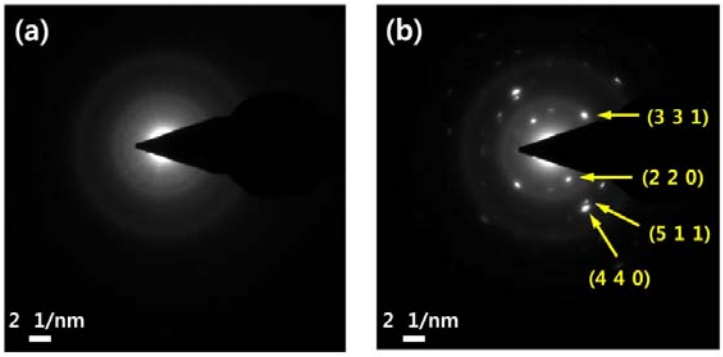

Fig. S3 Selected area electron diffraction (SAED) patterns of (a) lepidoctocite area and (b) mixed area of lepidocrocite and magnetite in the sample refluxed for 1 h.

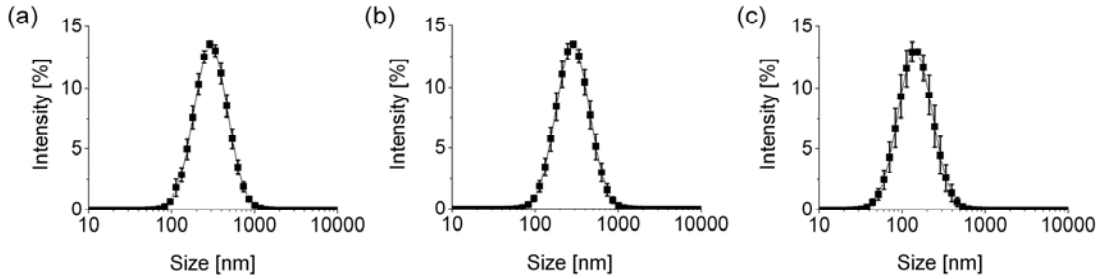

Fig. S4. Size distribution of isolated (a) ferrihydrite, (b) lepidocrocite, and (c) final MGNCs measured by dynamic light scattering (DLS) technique.

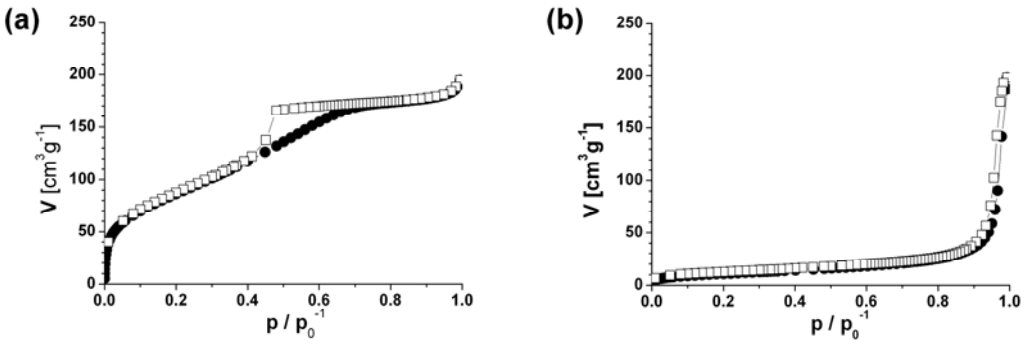

Fig. S5 N_2 adsorption (●) and desorption (□) isotherms of (a) lepidocrocite and (b) MGNCs. Calculations based on the Brunauer–Emmett–Teller (BET) specific surface area and the Barrett–Joyner–Halenda (BJH) pore-size distribution show that lepidocrocite and MGNCs have 322.17 m^2/g (average pore width: 3.74 nm) and 39.78 m^2/g (average pore width: 30.81 nm, this pores were probably caused by interstitial MGNCs), respectively.

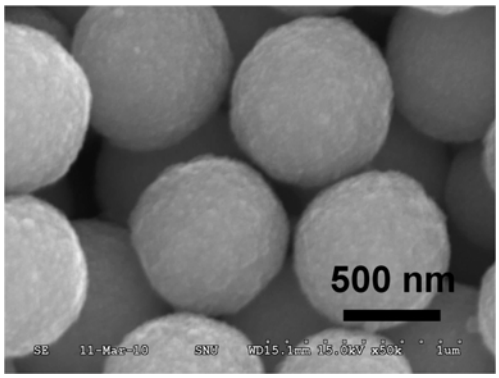

Fig. S6 SEM image of MGNC prepared by using sodium benzoate.

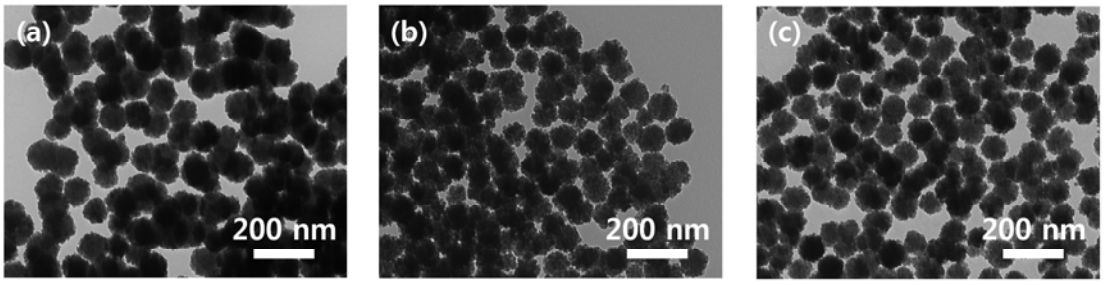

Fig. S7 TEM images of MGNCs prepared from the same molar ratios of $FeCl_3$: NaOAc : H_2O = 0.1 : 1.2 : 5.6 in 1.5 L of EG after keeping the ferrihydrite at room temperature for (a) 1 h, (b) 16 h, and (c) 28 h.

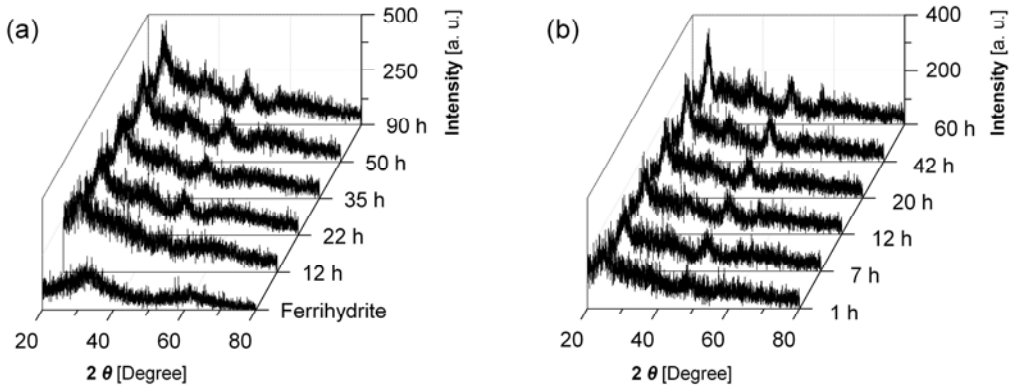

Fig. S8 XRD patterns of iron oxides prepared at different reipening temperature: after heating the ferrihydrite at (a) 70 °C and (b) 100 °C.

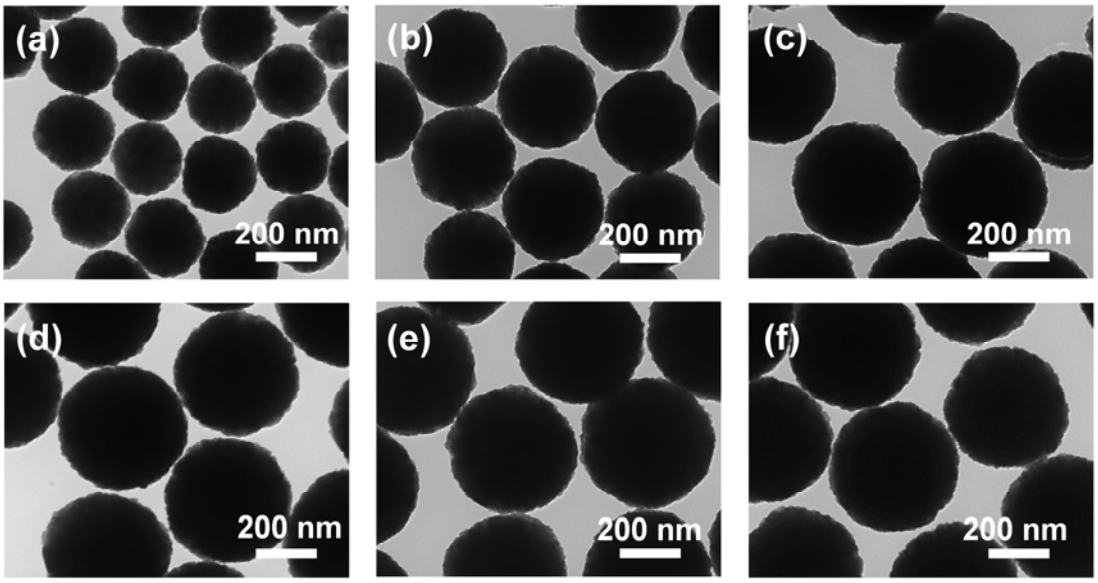

Fig. S9 TEM images of MGNCs prepared from the same molar ratios of $FeCl_3$: NaOAc : H_2O = 0.1 : 1.2 : 5.6 in 1.5 L of EG after heating the ferrihydrite at 100 ^oC for (a) 1 h, (b) 7 h, (c) 12 h, (d) 20 h, (e) 42 h, and (f) 60 h.

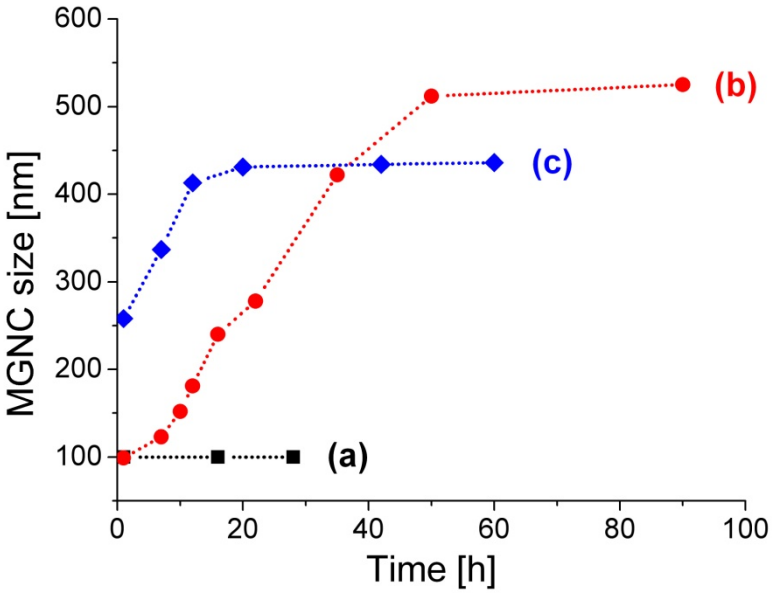

Fig. S10 Size distributions of resulted MGNCs as a function of heating time at (a) room temperature , (b) 70 °C, and (c) 100 ^oC.

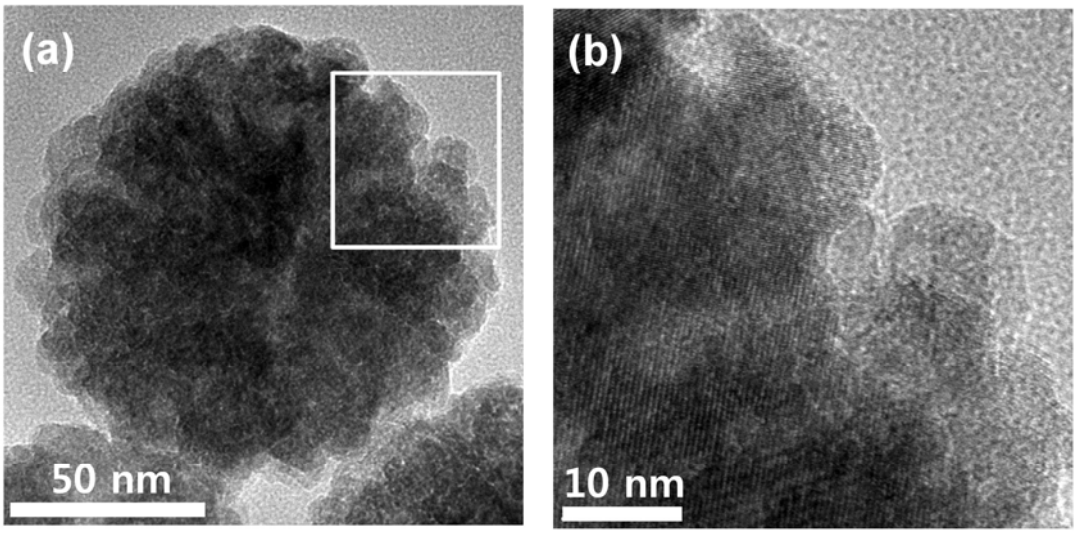

Fig. S11 Typical HRTEM images of MGNC; (b) HRTEM image of the white boxed resgion of part (a).

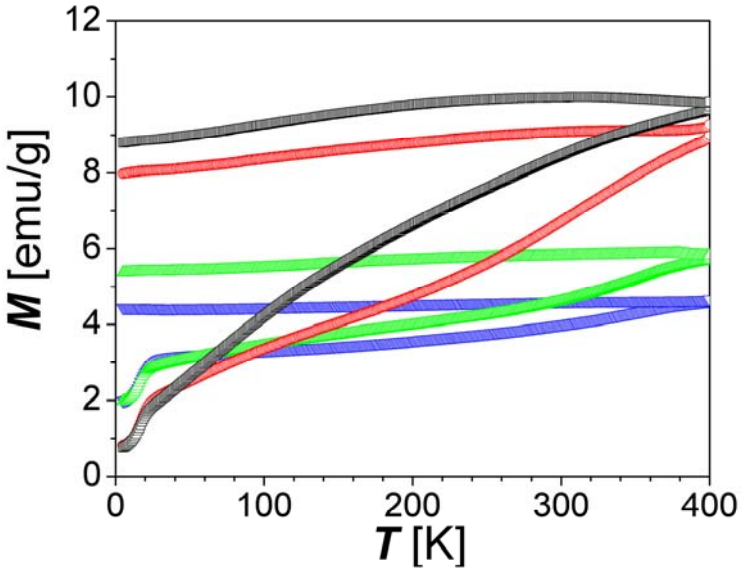

Fig. S12 ZFC/FC curves of MGNCs for 50 nm (black), 100 nm (red), 200 nm (green), and 400 nm (blue).