Electronic Supplementary Information:

Colloidal Synthesis of Greigite Nanoplates with Controlled Lateral Size for Electrochemical Applications

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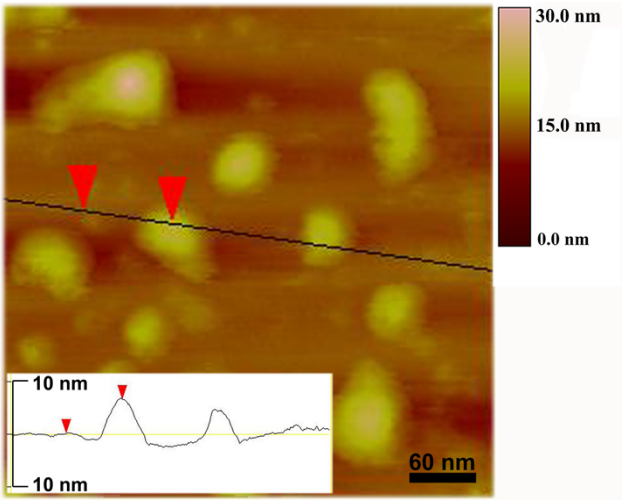

Figure S1. AFM observation of the as-synthesized Fe_3S_4 NPs at the reaction temperature of 220 ^oC. The average thickness of NPs is 6.5 nm.

Figure S2. The proposed mechanism of the reduction of sulfur ion. The reduction reaction is shown blow. FeS_2 is composed of one Fe^{2+} and two S^-, and Fe_3S_4 is composed of one Fe^{2+}, two Fe^{3+}, and four S^{2-}. In the reaction system, both Fe(III) and FeS_2 coordinate with ODA, which possesses weak reducibility. One ODA can provide one electron by β-hydride elimination.

$$Fe(NH\text{-}R)_3 + 2FeS_2(NH_2\text{-}R)_x \rightarrow Fe_3S_4(NH_2\text{-}R)_{2x-3} + 6R\text{-}NH_2$$

	Fe_3S_4 NPs	FeS_2 nucleus	Fe-ODA complexes
Fe/S molar ratio	1/1.29	1/1.74	1/5.97

Table S1. The Fe/S molar ratio in the products, which is obtained from EDX measurement.

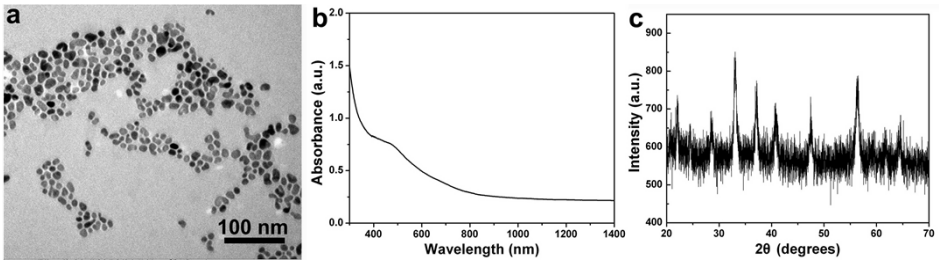

Figure S3. TEM image (a), UV-vis absorption spectrum (b), and XRD pattern (c) of the as-synthesized nanocrystals. The Fe source is $FeCl_3 \cdot 6H_2O$. The nanocrystals are pure phase FeS_2.

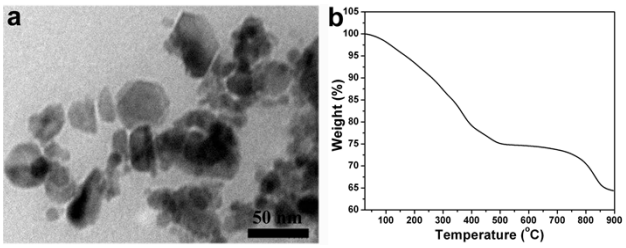

Figure S4. (a) TEM image of the Fe_3S_4 NPs after annealing at 400 °C for 2 h under Ar atmosphere. (b) Thermogravimetric analysis profile of Fe_3S_4 NPs heated in N_2 from room temperature to 900 °C.

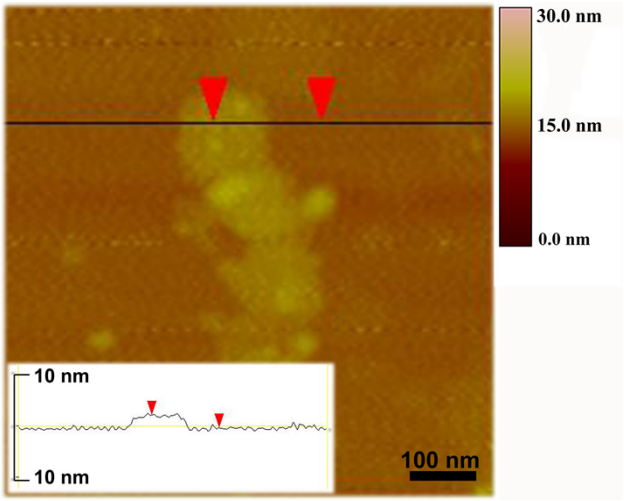

Figure S5. AFM observation of the as-synthesized Fe_3S_4 NPs at the reaction temperature of 200 ^oC. The average thickness of NPs is 2.5 nm.

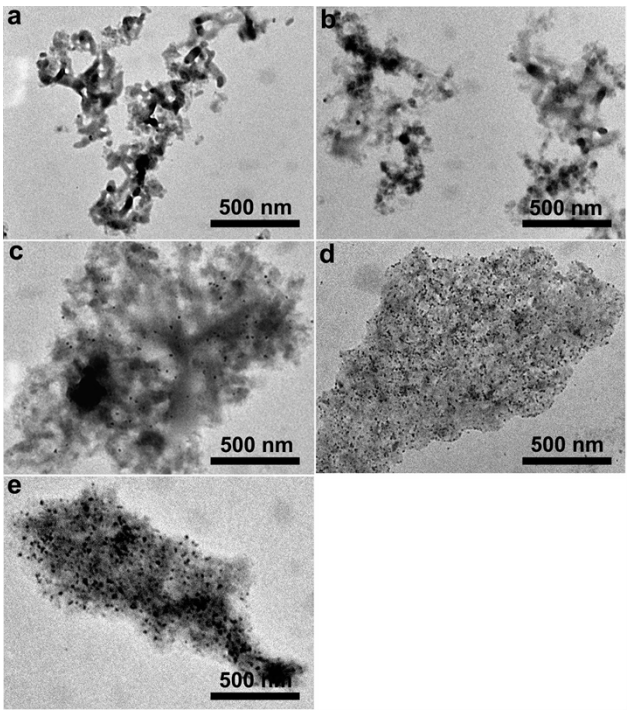

Figure S6. TEM images of the products captured at nucleation stage with the DE/ODA volume ratio of 0.7/1 (a), 1/1(b), 2/1 (c), 5/1 (d), and 11/1 (e), which reveal the increase of the number of FeS_2 nucleus as increasing DE.

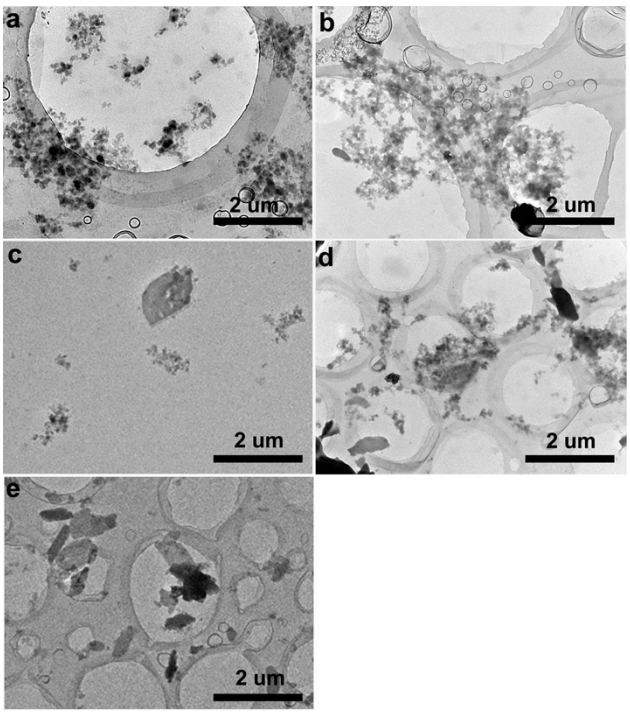

Figure S7. TEM images of the products captured at nucleation stage with the Fe/S feed ratio of 1/4 (a), 1/5 (b), 1/6 (c), 1/7 (d), and 1/8 (e), which reveal the decrease of the number of FeS_2 nucleus as decreasing Fe source.

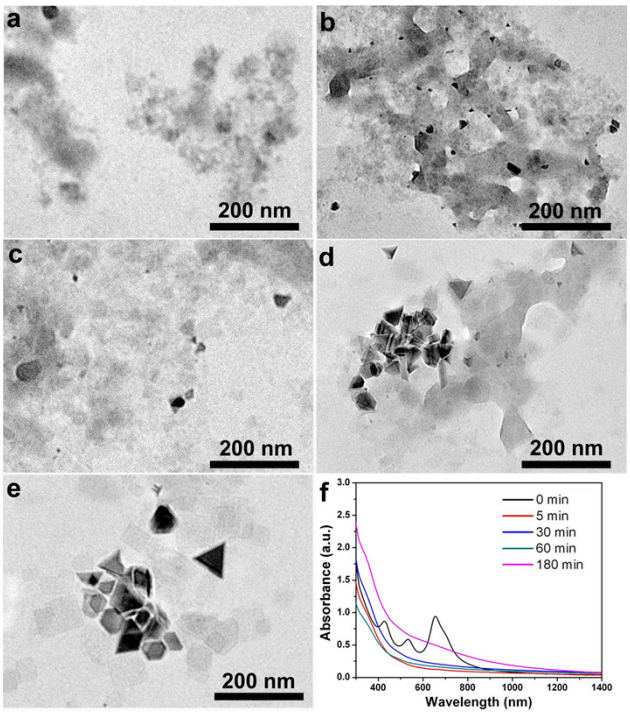

Figure S8. The temporal evolution of Fe_3S_4 NPs which is revealed by TEM observation. (a) 0 min, (b) 5 min, (c) 30 min, (d) 60 min, and (e) 180 min. (f) The corresponding absorption spectra. The DE/ODA volume ratio is 1/1.

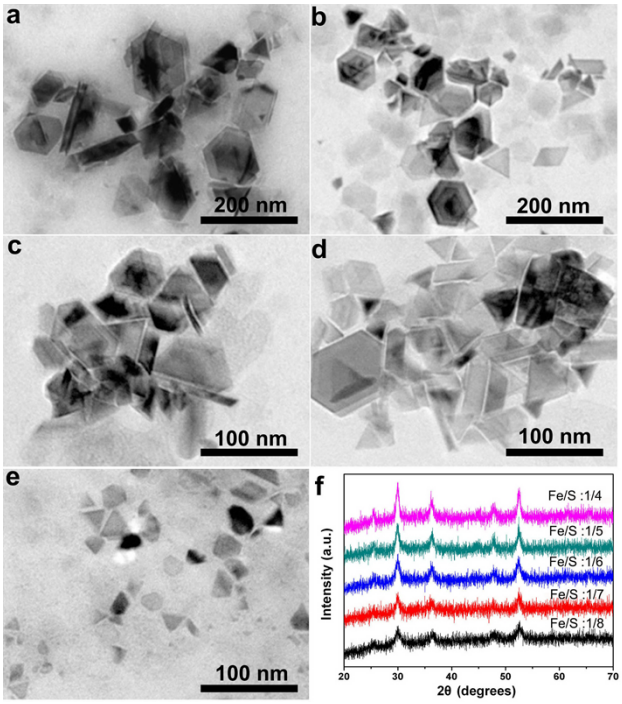

Figure S9. TEM images of the Fe_3S_4 NPs synthesized with the Fe/S molar feed ratio of 1/4 (a), 1/5 (b), 1/6 (c), 1/7 (d), and 1/8 (e), which reveal the decrease of lateral size as increasing S. (f) The corresponding XRD patterns.

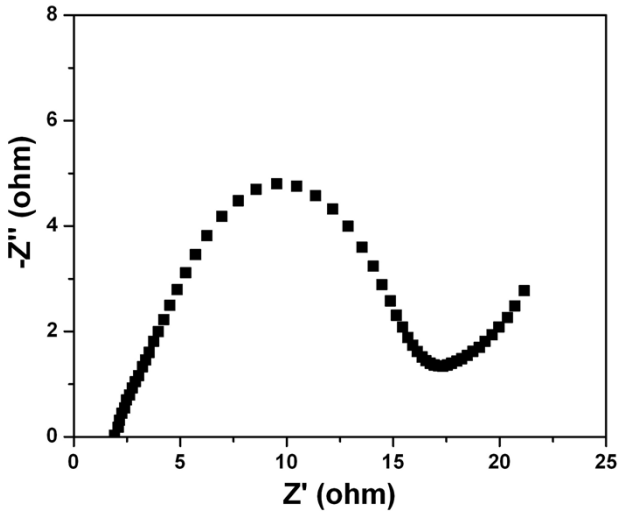

Figure S10. EIS profile of a fresh Fe_3S_4-based coin cell.

Samples	*Re*	*Rf*	*Rct*
3rd	2.4	25.9	146.9
5th	2.8	28.6	128.5
7th	5.3	15.1	72.5
15th	3.6	17.2	38.3
20th	3.8	16.8	36.7

Table S2. Kinetic parameters of the Fe_3S_4-based electrode at different cycles.

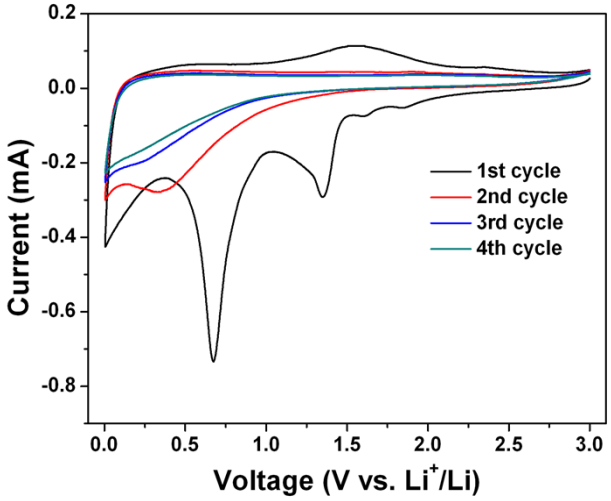

Figure S11. Cycle voltammetry profiles of the first four cycles for the Fe_3S_4-based electrode at a scanning rate of 0.1 mV/s in the voltage window of 0.001-3.0 V (Li^+/Li).