Electronic Supplementary Information (ESI)

Dodecylamine-derived thin carbon-coated single Fe_3O_4 nanocrystals for advanced lithium ion batteries

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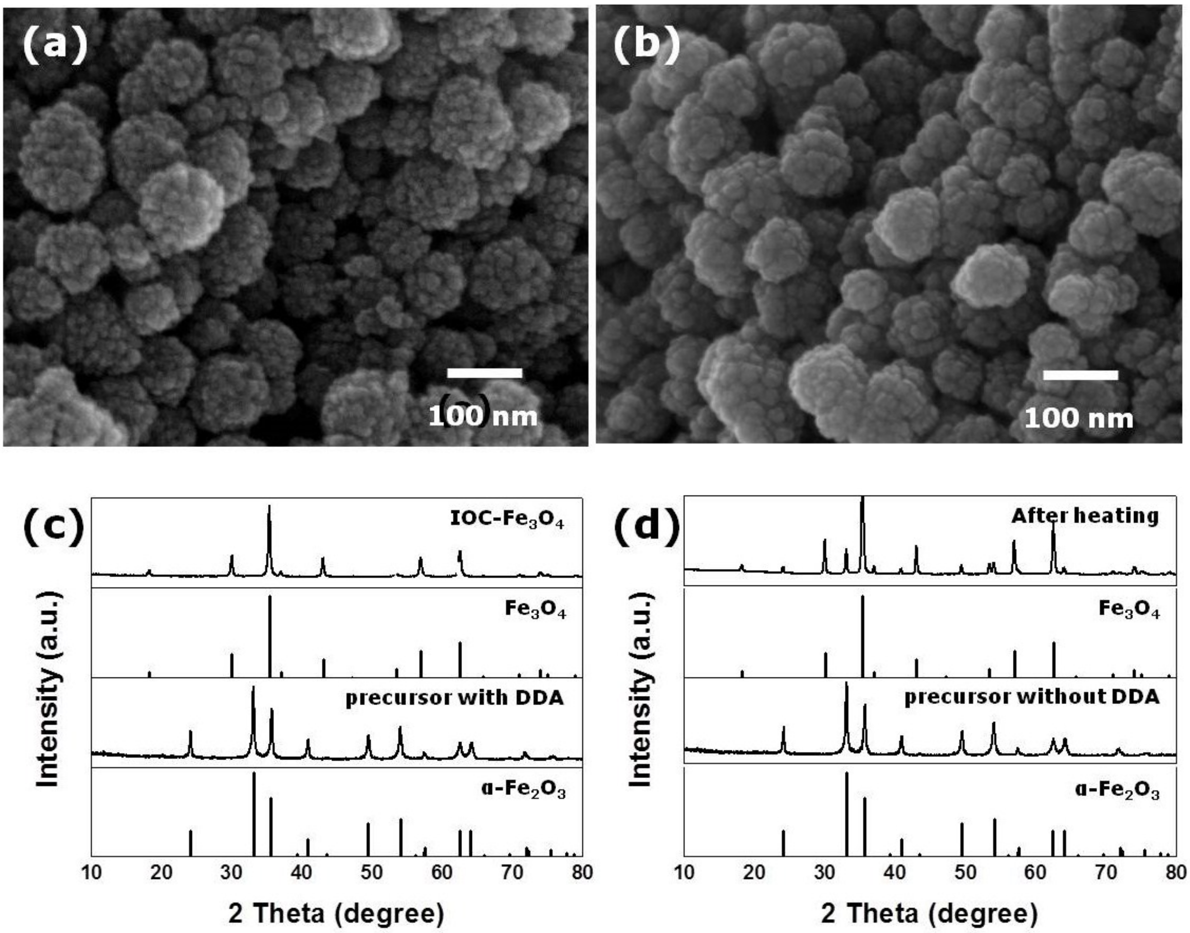

Fig. S1 FE-SEM images of the precursors (a) with and (b) without DDA. XRD patterns of precursors and synthesized samples after heat treatment at 500 °C for 4 h under argon (c) with and (d) without DDA.

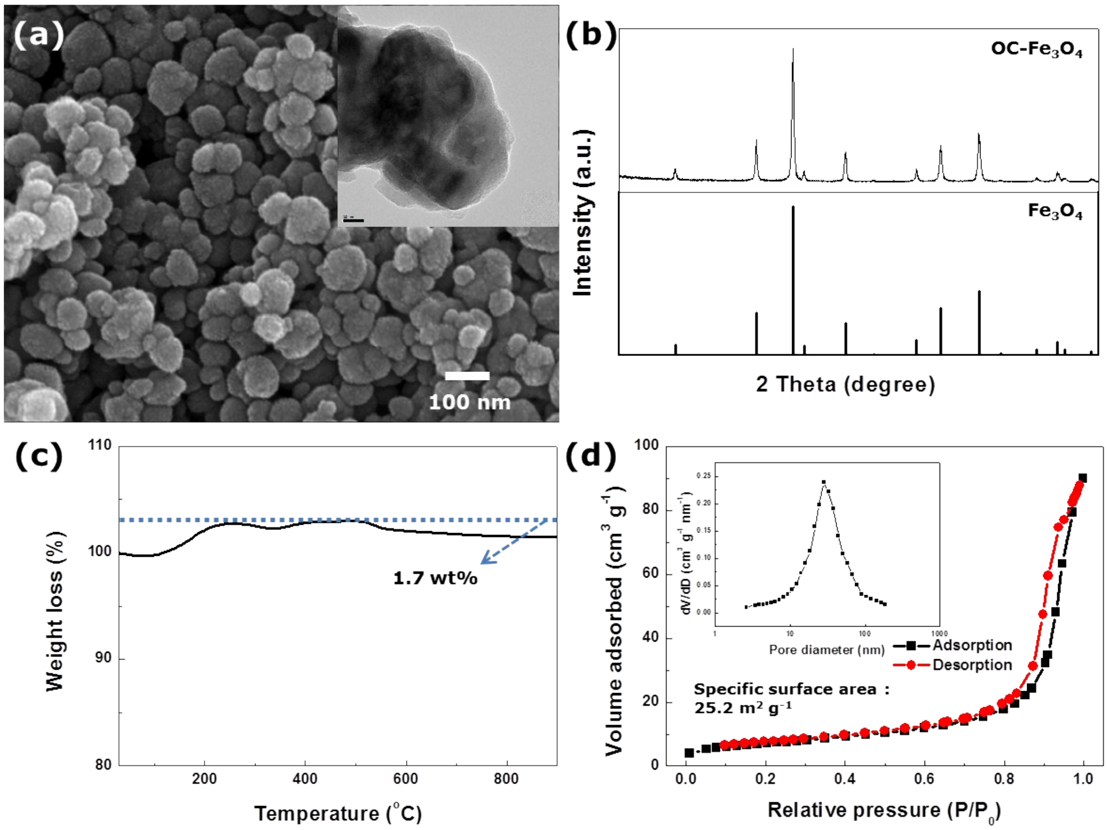

Fig. S2 (a) FE-SEM image (inset: TEM image), (b) XRD pattern, (c) TGA curve, and (d) N_2 adsorption-desorption isotherms (inset shows the pore size distribution by the BJH method) of the OC-Fe_3O_4 sample, which was synthesized without dodecylamine and then carbon layer added to the surface.

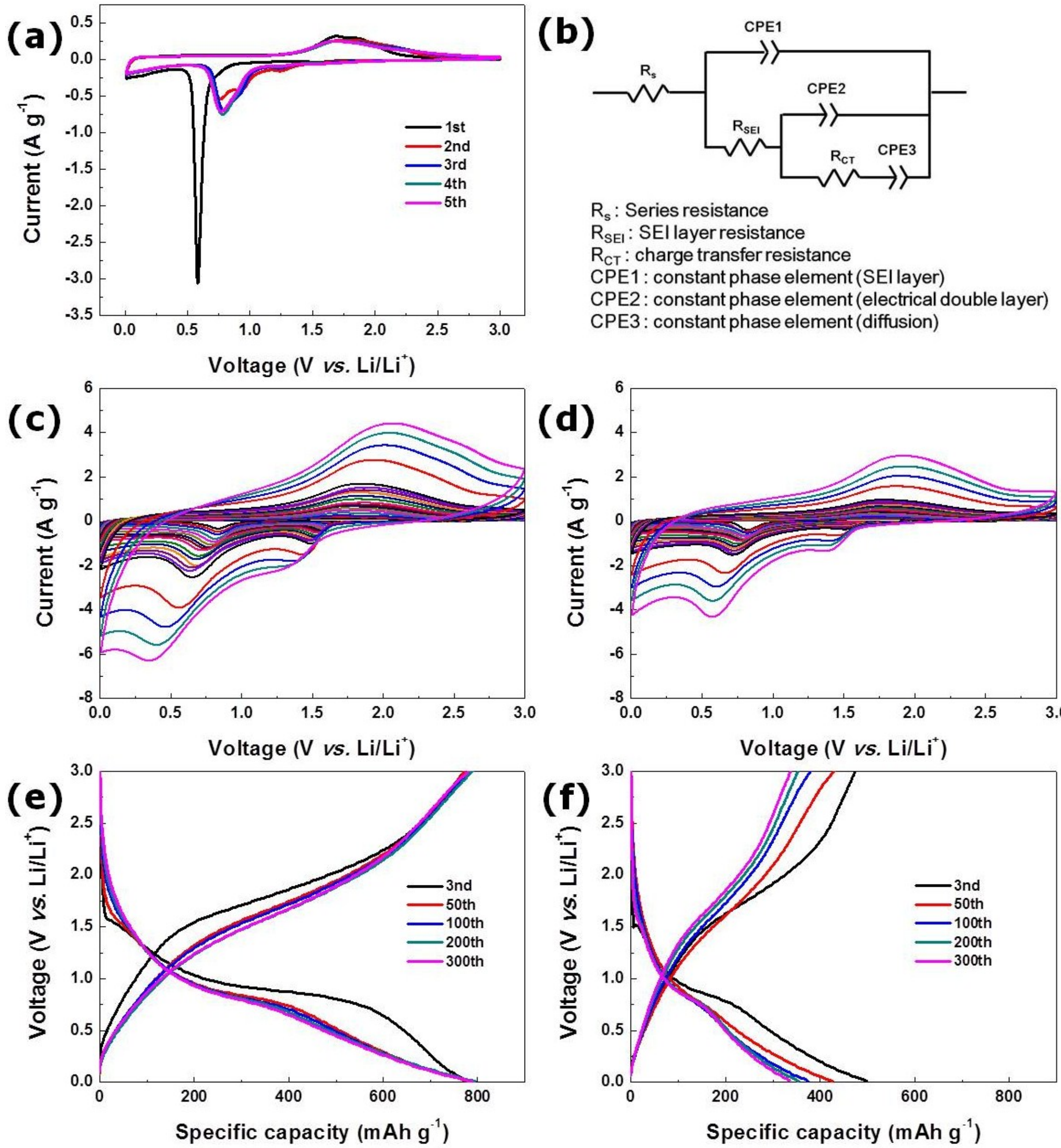

Fig. S3 The second CV curves of (a) OC-Fe_3O_4 during the initial three cycles at a scan rate of 0.1 mV s^{-1}. (b) The equivalent circuit model for fitting the EIS plots. The second CV curves of (c) IOC-Fe_3O_4 and (d) OC-Fe_3O_4 in the voltage range of 0.01–3 V vs. Li/ Li^+ at various scan rates from 0.04 to 10 mV s^{-1}. Charge and discharge profiles of (e) IOC-Fe_3O_4 and (f) OC-Fe_3O_4 during 300 cycles at a current density of 1 A g^{-1}.

Table S1. The carbon contents and electrochemical performances of various Fe_3O_4 composited or coated with carbonaceous materials.

Materials	Carbon content (wt.%)		Total carbon content (wt%)	Current density (mA g^{-1})	Capacity (mAh g^{-1})	Ref.
	Composited or coated material	Conductive agent				
Fe_3O_4@C	4.2	10	14.2	3000	563	In this study
Fe_3O_4@C	21.5	15	36.5	4620	190	1
Fe_3O_4@C	54.6	20	74.6	800	118	2
Fe_3O_4@C	18	10	28	1000	702	3
Fe_3O_4@C	19	10	29	1000	290	4
Fe_3O_4@C	17	10	27	2000	341	5
N-doped carbon coated Fe_3O_4	16	15	31	2000	396	6
Graphene@Fe_3O_4	13.3	10	23.3	1750	520	7
Graphene@Fe_3O_4	35.2	10	45.2	2500	393	8
Graphene oxide@Fe_3O_4	45.5	10	55.5	2000	385	9
Porous carbon fiber@Fe_3O_4	39.2	20	59.2	2000	523	10

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Table S2. Resistance parameters fitted by the equivalent circuit model (Fig. S3b) for IOC-Fe_3O_4 and OC-Fe_3O_4.

Sample	Process	R_S (Ω)	R_{SEI} (Ω)	R_{CT} (Ω)
IOC-Fe_3O_4	Discharge	4.69	17.37	36.49
	Charge	4.28	18.81	32.67
OC-Fe_3O_4	Discharge	6.14	41.29	51.75
	Charge	6.26	35.4	38.82