Supporting information

Uniformly Core-shell Nanobiscuits of Fe_7S_8@C for Lithium-ion and Sodium-ion Batteries with Excellent Performance

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Table S1. A comparison of electrochemical properties of metal sulfides for LIBs and SIBs.

Types of materials	Types of battery	Voltage range(V)	Cycling performance	Reference
CoS_2 Nanobubble Hollow Prisms	LIBs	0.05-3	737 mAh g^{-1} after 200 cycles at 1 A g^{-1}	1
CoS/C	SIBs	0.01-3	542 mAh g^{-1} after 2000 cycles at 1 A g^{-1}	2
Fe_7S_8@C NCs	SIBs	0.08-3	447 mAh g^{-1} after 1000 cycles at	3

			180 mA g^{-1}	
Hollow nanocubes PBC1-1S	SIBs	0.01-3	87 mAh g^{-1} after 150 cycles at 500 mA g^{-1}	4
NiS nanoplates	LIB	0.005-3	468 mAh g^{-1} after 100 cycles at 1 A g^{-1}	5
	SIBs	0.005-3	166 mAh g^{-1} after 100 cycles at 1 A g^{-1}	
CoS_2/NCNTF electrode	LIBs	0.05-3	973 mAh g^{-1} after 160 cycles at 1A g^{-1}	6
$Fe_3O_4/Fe_{1-x}S$@C@MoS_2 nanosheets	LIBs	0.01-3	1142 mAh g^{-1} after 700 cycles at 1A g^{-1}	7
	SIBs	0.01-3	402 mAh g^{-1} after 1000 cycles at 1A g^{-1}	
FeS_2@C yolk-shell nanoboxes	SIBs	0.1-2	330 mAh g^{-1} after 800 cycles at 2A g^{-1}	8
Mesoporous NiS_2 Nanospheres	SIBs	0.01-2.9	319 mAh g^{-1} after 1000 cycles at 500 mA g^{-1}	9
MoS_2/SnS_2-GS	LIBs	0.01-3	772 mAh g^{-1} after 200cycles at 750 mA g^{-1}	10
	SIBs	0.01-3	546 mAh g^{-1} after 150 cycles at 1.5 A g^{-1}	
TiO_2@NC@MoS_2	LIBs	0.01-3	590 mAh g^{-1} after 200 cycles at 1 A g^{-1}	11
EG-MoS_2	LIBs	0.01-3	1250 mAh g^{-1} after 150 cycles at 1 A g^{-1}	12
	SIBs	0.01-3	509 mAh g^{-1} after 250 cycles at 1 A g^{-1}	
spongy CoS_2/C	LIBs	0.01-3	610 mAh g^{-1} after 120 cycles at 500 mA g^{-1}	13

	SIBs	0.01-3	358.7 mAh g^{-1} after 60 cycles at 500 mA g^{-1}	
SnS@C nanotubes	SIBs	0.01-3	440.3 mAh g^{-1} after 100 cycles at 200 mA g^{-1}	14
ce-V_5S_8-C	SIBs	0.01-3	496 mAh g^{-1} after 500 cycles at 1 A g^{-1}	15
$Fe_{1-x}S$@CNTs	SIBs	0.01-2.3	449.2 mAh g^{-1} after 200 cycles at 500 mA g^{-1}	16
Fe_7S_8@C NCs	SIBs	0.08-3	447 mAh g^{-1} after 1000 cycles at 180 mA g^{-1}	17
FeS@CNS	LIBs	0.01-3	703 mAh g^{-1} after 150 cycles at 1 A g^{-1}	18
G@FeS-GNRs	LIBs	0.01-3	536 mAh g^{-1} after 100 cycles at 400 mA g^{-1}	19
FeS_2/CNT	SIBs	0.8-3	394 mAh g^{-1} after 400 cycles at 200 mA g^{-1}; 309 mAh g^{-1} after 1800 cycles at 1 A g^{-1}	20
Fe_7S_8@C	LIBs	0.01-3	**781 mAh g^{-1}** after 500 cycles at 1 A g^{-1}, **547.3 mAh g^{-1}** after 600 cycles at 5 A g^{-1}	**This work**
	SIBs	0.01-3	**596 mAh g^{-1}** after 500 cycles at 1 A g^{-1}, **530.8 mAh g^{-1}** after 1000 cycles at 5 A g^{-1}	**This work**

Table S2. Values of Rct obtained by fitting date.

	Li^+/Rct(Ω)	Na^+/Rct(Ω)
Before cycle	52.25	10.05
After cycle	18.62	7.645

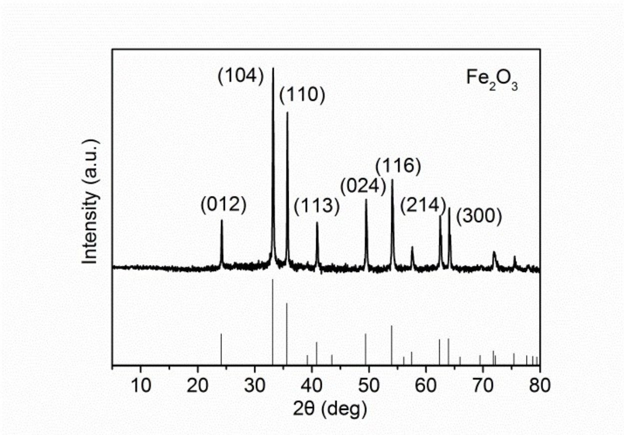

Fig. S1. XRD spectra of the pure Fe_2O_3.

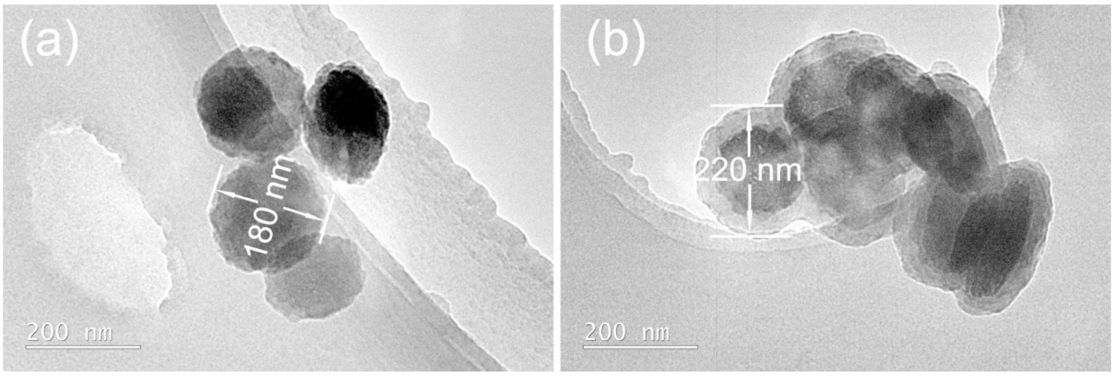

Fig. S2. TEM images of (a) Fe_2O_3 and (b) Fe_2O_3@PDA.

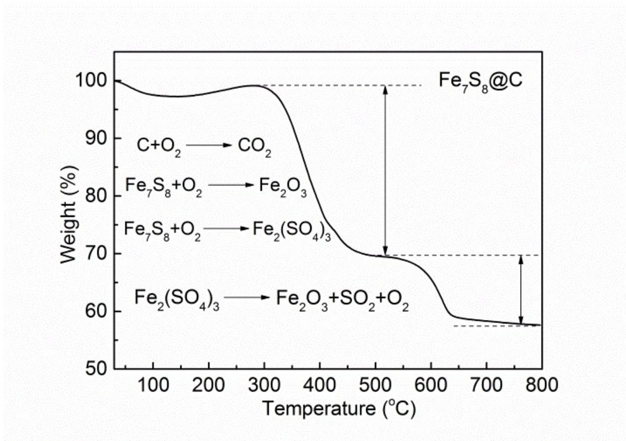

Fig. S3. TGA curves of Fe_7S_8@C.

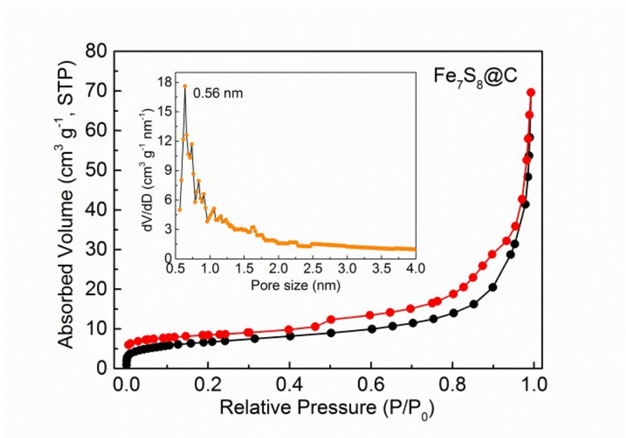

Fig. S4. The nitrogen adsorption/desorption isotherm plots. Micropore (inset) size distribution of Fe_7S_8@C.

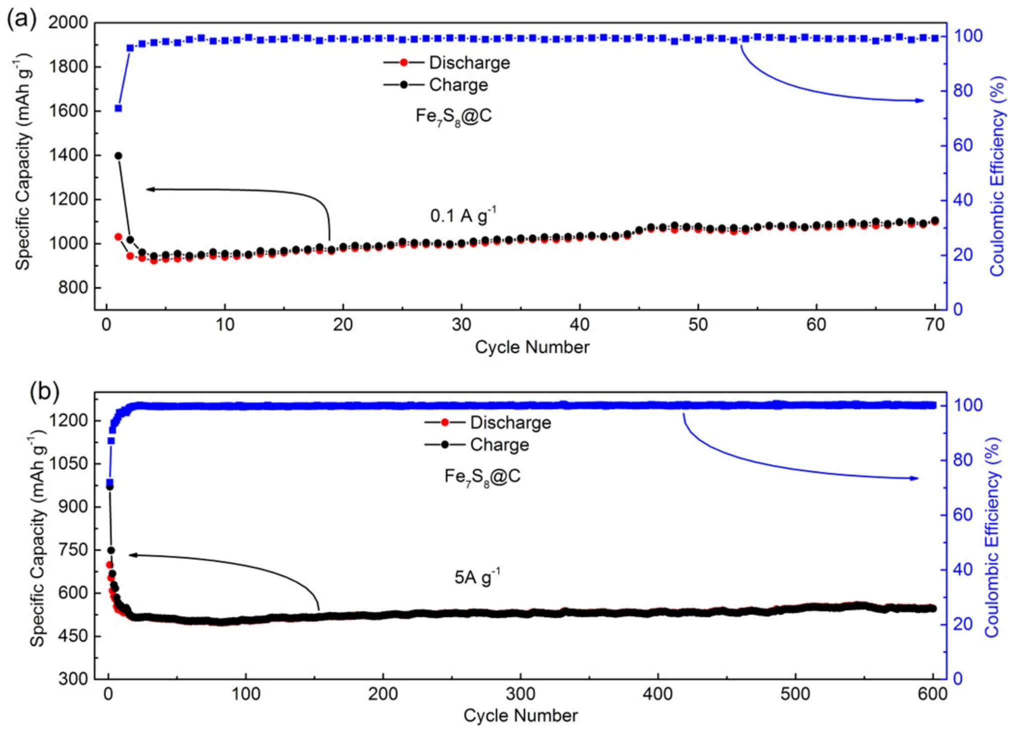

Fig. S5. Long-term cyclic performance at current densities of 0.1 A g^{-1} (a) and 5 A g^{-1} (b) for LIBs.

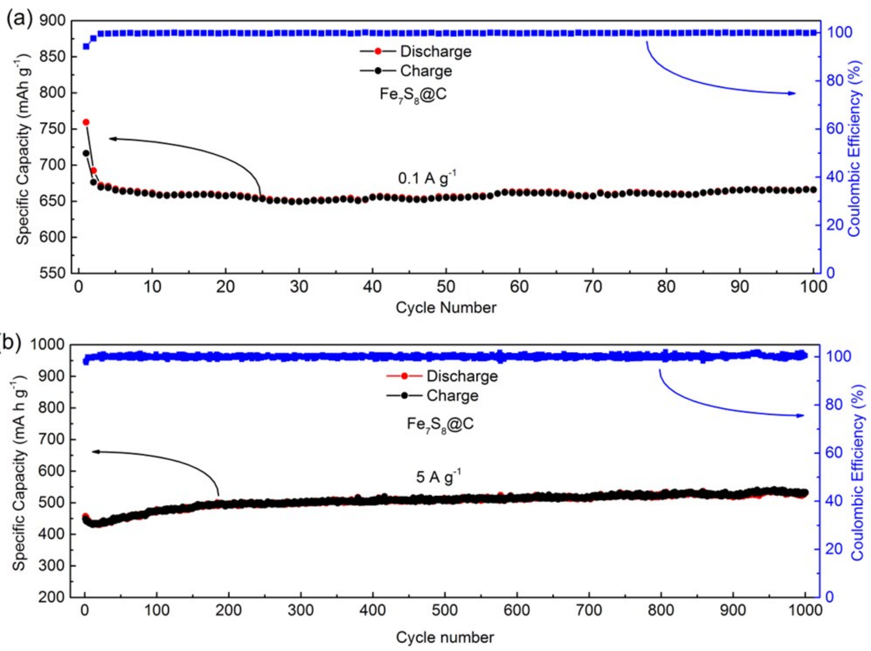

Fig. S6. Long-term cyclic performance at current densities of 0.1 A g^{-1} (a) and 5 A g^{-1} (b) for SIBs.

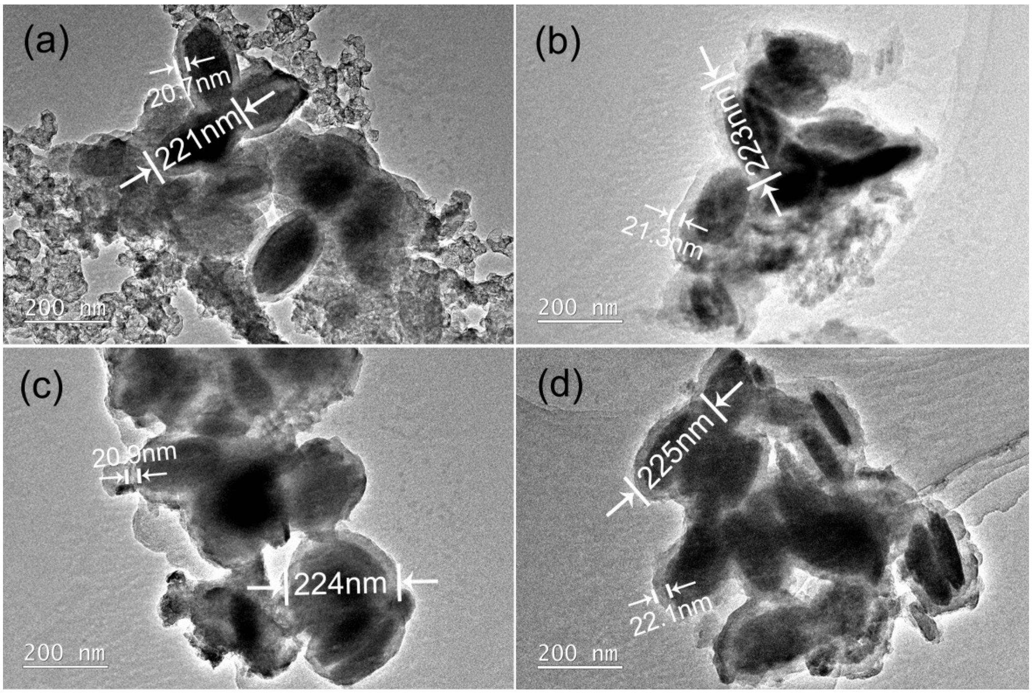

Fig. S7. TEM images of Fe_7S_8@C nanobiscuits electrodes after 1st cycle (a, c) and 500th cycle (b, d) at the current density of 1 A g^{-1} for (a, b) LIBs and (c, d) SIBs.

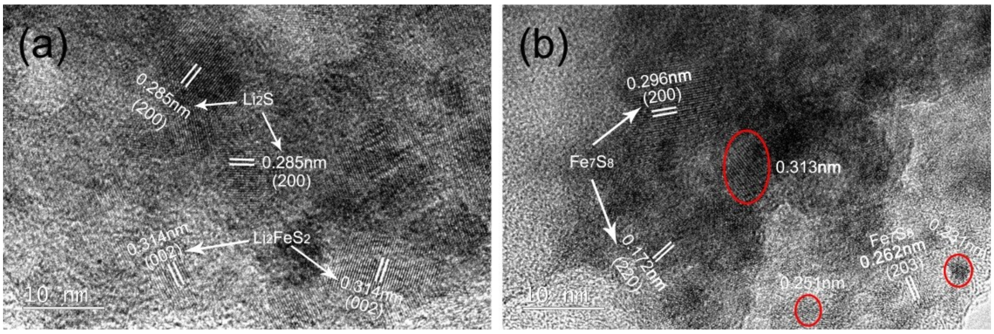

Fig. S8. Ex-situ HRTEM for LIBs (a) and SIBs (b) after first cycle, both batteries charge to 2 V.

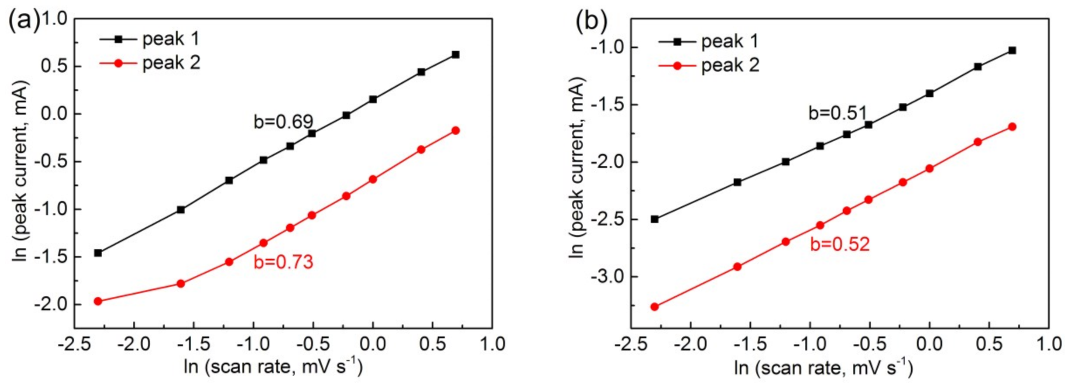

Fig. S9. The fitted lines and ln (peak current) *versus* ln (scan rate) plots at different oxidation (black) and reduction (red) state of (a) LIBs and (b) SIBs.

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