Electronic Supplementary Information (ESI)

A Novel Nanosphere-in-Nanotube Iron Phosphide Li-Ion Battery Anode Displaying a Long Cycle Life, Recoverable Rate-Performance, and Temperature Tolerance

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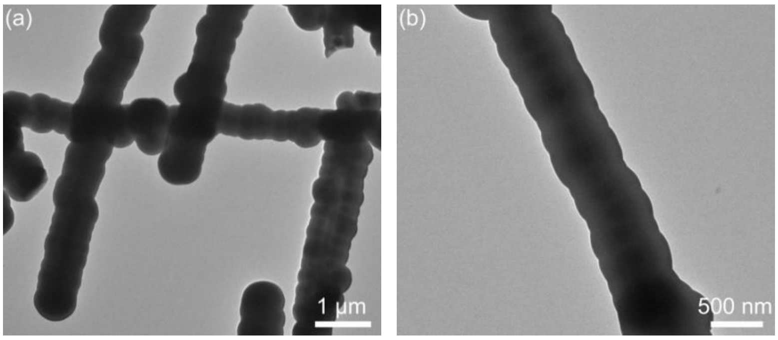

Fig. S1 (a, b) TEM images of 1D Fe_3O_4@SiO_2.

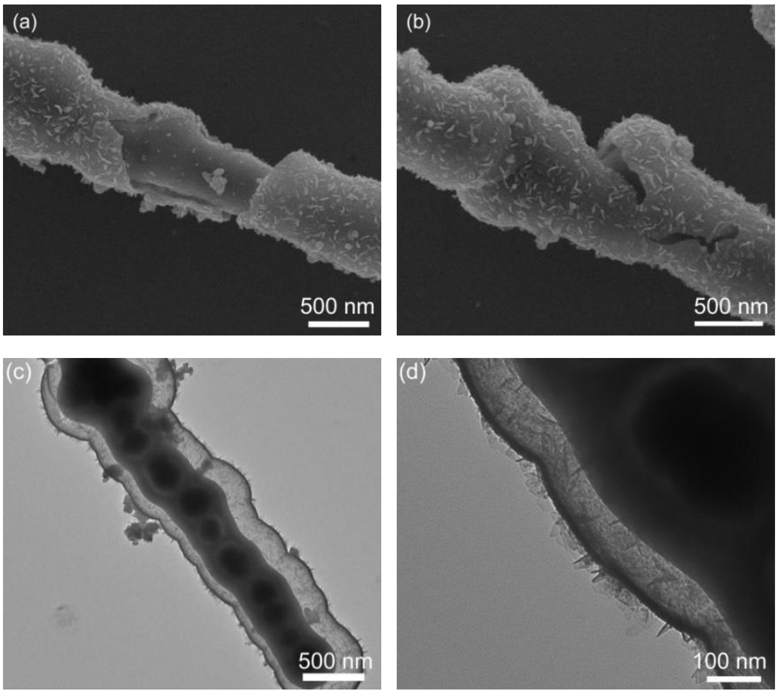

Fig. S2 (a,b) SEM images of a manually-broken Fe_3O_4@SiO_2@FeOOH showing the thickness and the coating layer. (c,d) TEM images of Fe_3O_4@SiO_2@FeOOH.

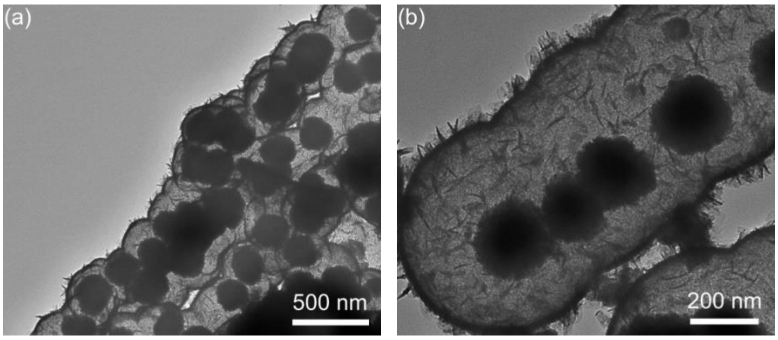

Fig. S3 (a,b) TEM images of 1D yolk-shell Fe_3O_4@void@FeOOH.

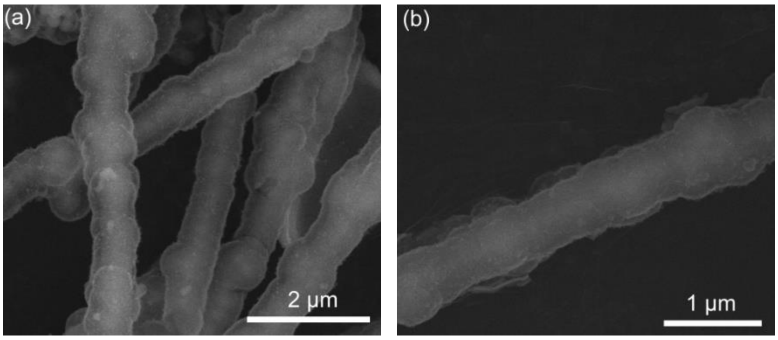

Fig. S4 (a,b) SEM images of the NNYS FeP.

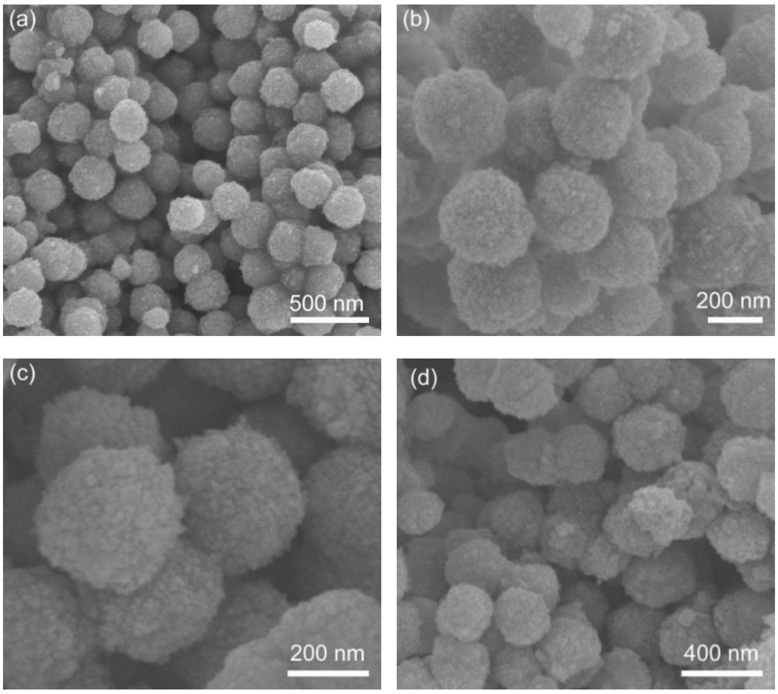

Fig. S5 SEM images of (a) the Fe_3O_4, (b) the Fe_3O_4@SiO_2@FeOOH, (c,d) the yolk-shell FeP nanospheres.

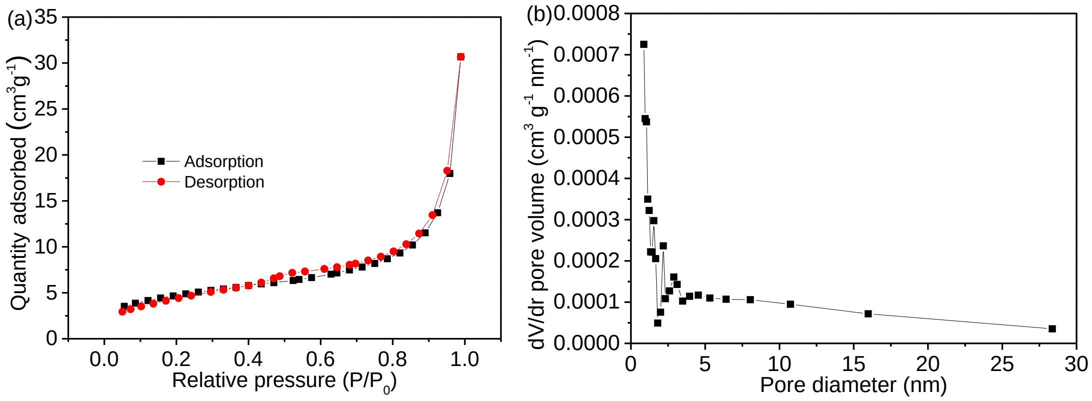

Fig. S6 (a) N_2 adsorption-desorption isotherm and (b) pore-size distribution of the NNYS FeP.

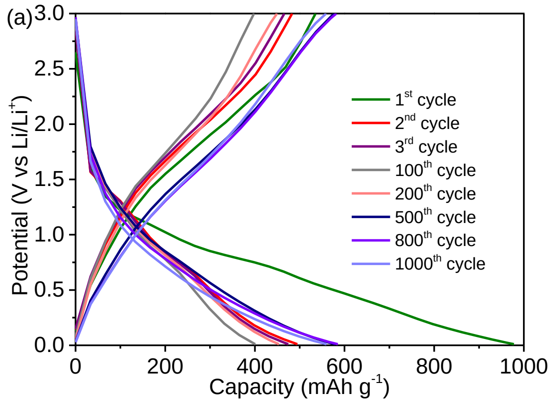

Fig. S7 (a) Charge-discharge profiles of the NNYS FeP anode cycling at 2 A g^{-1}.

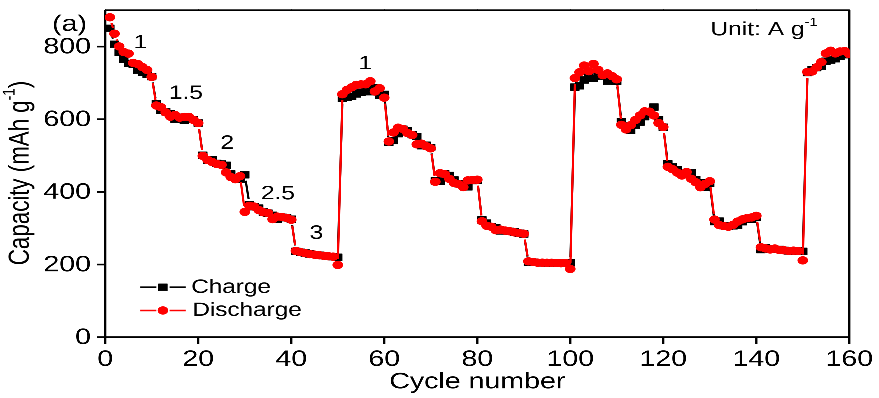

Fig. S8 (a) Rate-performance of the NNYS FeP at some higher current densities.

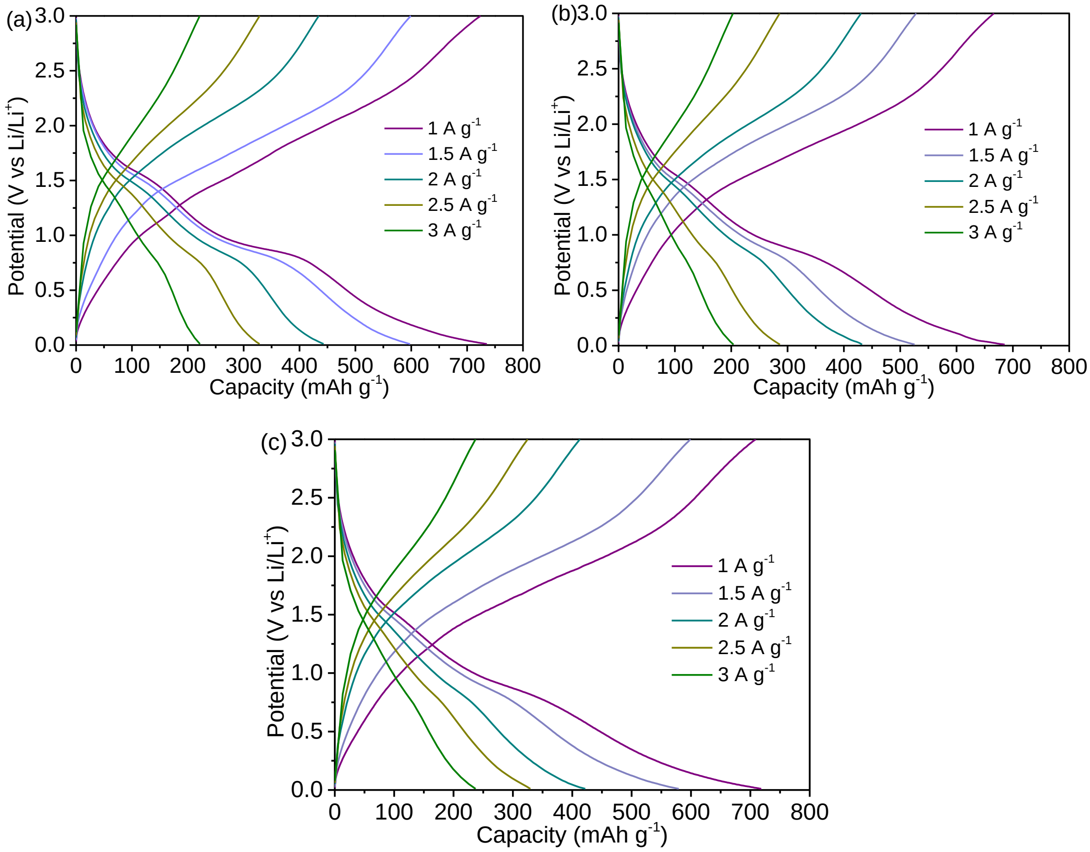

Fig. S9 Charge-discharge curves of the NNYS FeP anode at the (a) first, (b) second, and (c) third round of rate-performance tests. The profiles are from the last cycle at each rate.

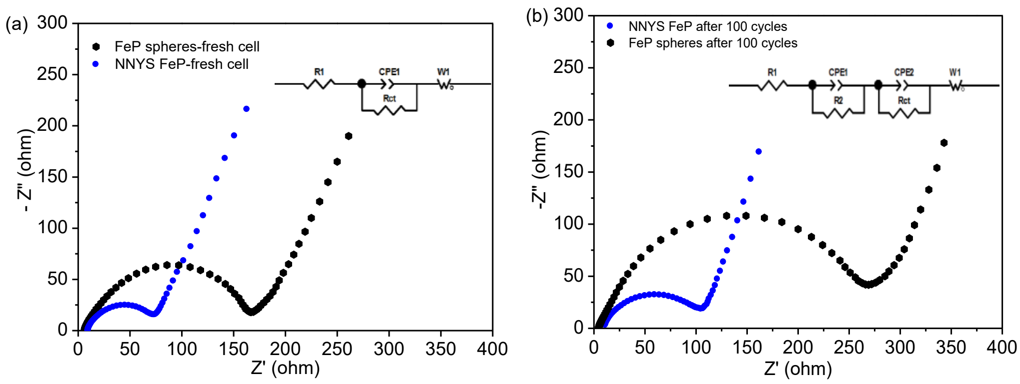

Fig. S10 EIS spectra of the NNYS FeP and the FeP nanospheres (a) before and (b) after 100 cycles at 0.2 A g^{-1}. The fitted equivalent circuits are displayed by the inserts.

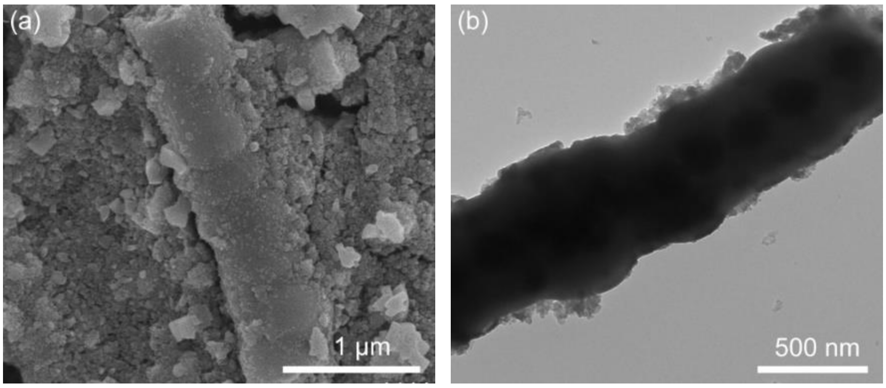

Fig. S11 (a) SEM and (b) TEM images of the NNYS FeP after 100 cycles at 0.2 A g^{-1}.

Table S1. Comparison on the electrochemical performance of some FeP-based anodes.

Anode	Preparation method	Cycling rate (mA g^{-1})	Cycle number	Capacity (mAh g^{-1})	Ref.
FeP@N-doped carbon	Solvothermal method	500	300	569	[1]
Yolk-shell FeP@C	Phosphidation approach	1000	600	413	[2]
Graphene⊥FeP@C-nanorod array	Modified Hummers' method	2000	2000	310	[3]
Yolk-shell FeP@C nanoboxes	Phosphidation approach	500	400	476	[4]
Hollow FeP@C@graphene	Hydrothermal approach	200	100	771	[5]
FeP@C networks	Calcination process	2000	1000	504	[6]
FeP/Ni_2P/C@C	Solvothermal method	500	100	426	[7]
FeP@C/reduced graphene oxide	Hydrothermal and phosphorization method	1000	500	596	[8]
The NNYS FeP	Magnetic field-assisted and templated approach	2000	1000	560	This study

Table S2. Charge transfer resistance of the NNYS FeP within one charge-discharge cycle.

Discharging potential (V)	Charge transfer resistance (Ω)	Charging potential (V)	Charge transfer resistance (Ω)
2.78	45.5	0.41	89.5
2.55	51.5	0.61	78.7
2.31	72.2	0.81	53.6
2.14	74.8	1.0	37.1
1.98	66.8	1.2	33.7
1.77	53.0	1.41	23.6
1.49	54.9	1.62	33.9
1.23	34.1	2.0	38.5
0.94	28.3	2.25	23.8
0.71	34.6	2.5	20.8
0.44	16.5	2.71	16.2

References

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