Electronic Supplementary Material (ESI) for Materials Advances.

Supplementary Information

Sea-Urchin-like Iron-Cobalt Phosphide as Advanced Anode Material for Lithium Ion Battery

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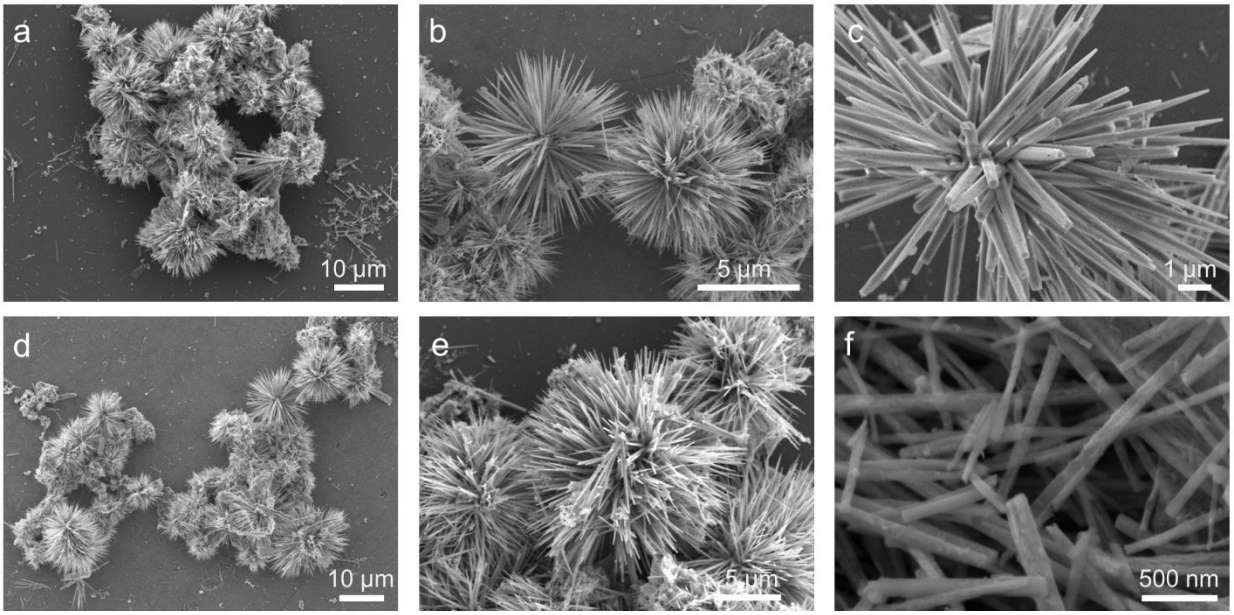

Fig. S1. FESEM images of the before and after phosphorization. (a-c) As-synthesized $FeCo(Co_3)_2OH$ after hydrothermal reaction and (d-f) FeCoP after phosphorization at 300 ℃ under the flow of N_2.

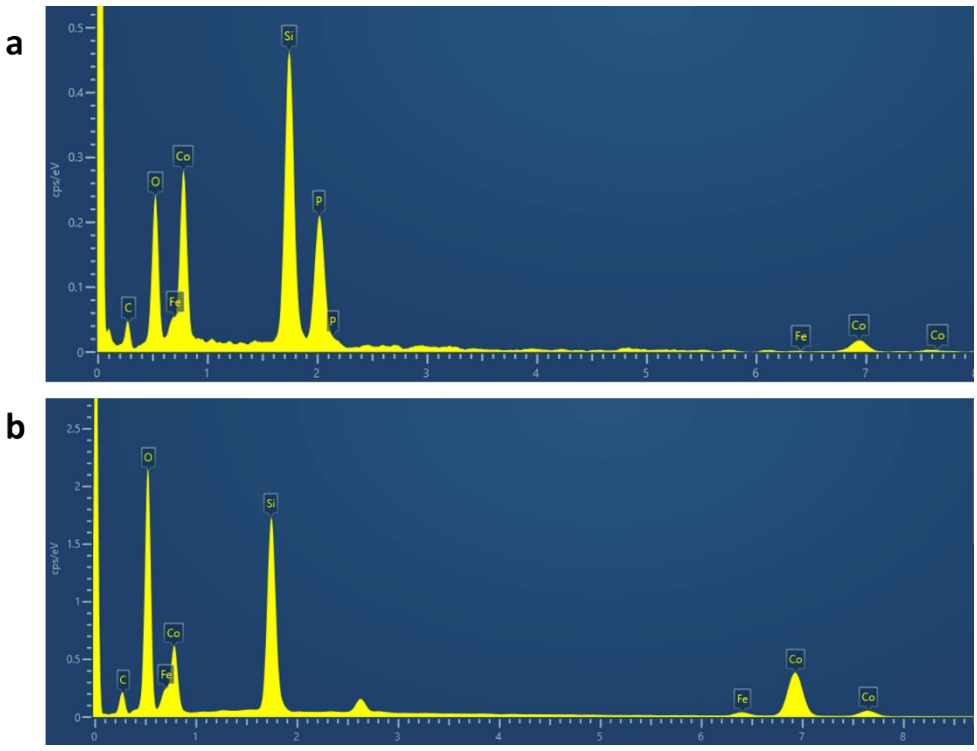

Fig. S2. EDS mapping before and after phosphorization. (a) the signal from $FeCo(Co_3)_2OH$, (b) the signal from FeCoP.

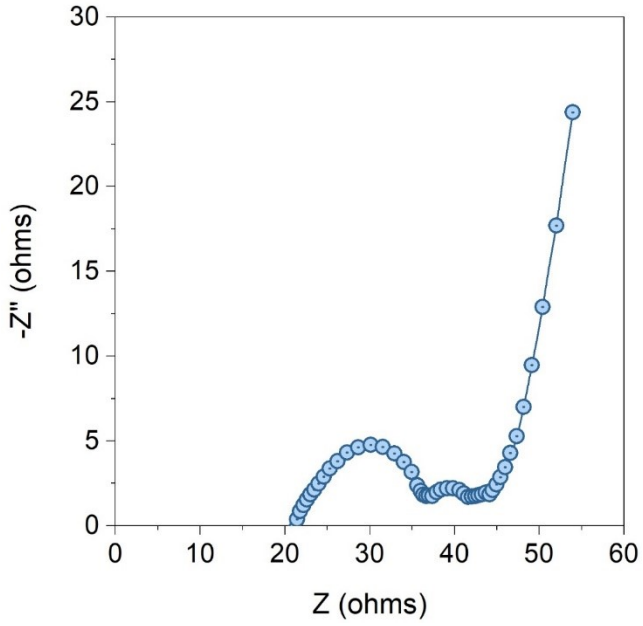

Fig. S3. EIS measurement of the device after 150th cycle showing the deceased charge transfer resistance (R_{ct}).

Table S1. FeCoP half-cell comparison with previously reported transition metal phosphides.

S.No	Material	Voltage window (V)	Electrolyte	Discharge Capacity (mAh g^{-1}) @ current rate	Ref.
1.	CoP/graphene	0-3	1 M $LiPF_6$ in a mixture of EC: EMC: DMC‡ in the ratio of 1: 1: 1	1154 @ 100 mA g^{-1}	1
2.	CoP@GA‡	0-3	1 M $LiPF_6$ in a mixture EC: DEC (1: 1 v/v)	1032.2 @ 100 mA g^{-1}	2
3.	CoP@GF‡	0-3	1 M $LiPF_6$ in a mixture of DMC: DEC: EC (1:1:1 vol%)	1120 @ 100 mA g^{-1}	3
4.	CoP/NC‡	0-3	1 M $LiPF_6$ in a mixture of EC/DMC (1: 1, v/v)	~800 @ 50 mA g^{-1}	4
5.	Co_2P	0-3	1 M $LiPF_6$ in a mixture of EC/DMC (1: 1, v/v)	780 @ 0.2 C	5
6.	CuP_2	0.02–2.5	$LiPF_6$-based electrolyte	865 @ 100 mA g^{-1}	6
7.	CoP/RGO‡	0.005-3	1 M $LiPF_6$ in a mixture of EC/DEC (1: 1, v/v)	1,274 @ 100 mA g^{-1}	7
8.	CoP@S‡	1.8-2.8	0.2 M Li_2S_6 +1M LiTFSI in 1,3-dioxolane and dimethoxyethane (1:1 in volume)	1020 @ 0.2 C	8
9.	Co_xP-NC-800	0-3	1 M $LiPF_6$ in a mixture of EC/DEC (1: 1, v/v)	1224 @100 mA g^{-1}	9
10	CoP@3DC‡	1.7–2.8	1 M LiTFSI in a DOL/DOM (v/v = 1:1)	1161.79 @ 0.2 C	10
11	FeCoP‡	0-3	1 M $LiPF_6$ in a mixture of EC/DMC (1: 1, v/v)	1653.4 @ 100 mA g^{-1}	This work

‡**Note:** ***EC:EMC:DMC-*** *Ethylene carbonate:ethylene methyl carbonate: dimethyl carbonate;* ***RGO-*** *Reduced graphene oxide;* ***GA-*** *graphene aerogel;* ***GF-*** *graphene framework membrane;****NC-*** *nitrogen-doped carbon;****S****-Sulfur;* ***3DC-*** *three-dimensional carbon frame embedded;* ***CoP****-Cobalt phosphide.*

XPS Analysis			
Sample	Element	Binding energy (eV)	Atomic percentage (%)
FeCoP			
	P	133.75	11.4
	C	284.8	25.46
	O	531.1	44.68
	Fe	710.91	9.16
	Co	781.1	9.3

BET surface area measurements				
Material	S_{BET} ($m^2 g^{-1}$)	S_{micro} ($m^2 g^{-1}$)	V_{pore} ($cm^3 g^{-1}$)	V_{micro} ($cm^3 g^{-1}$)
FeCoP	29.3	0	0.034	0

Half cell performance	
Current density ($mA g^{-1}$)	Specific discharge capacity ($mAh g^{-1}$)
100	1653.4
400	1091.2
500	1030.4
600	884.2
700	881.0
1000	820.8
5000	380.1

Table S2. Data summary for this work.

References

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