$LiCoO_2$ cathode surface modification with optimally structured Li_3PO_4 for outstanding high-voltage cycling performance

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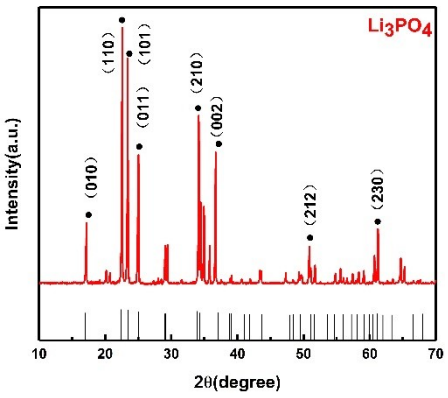

Fig.S1 The XRD patterns of Li_3PO_4

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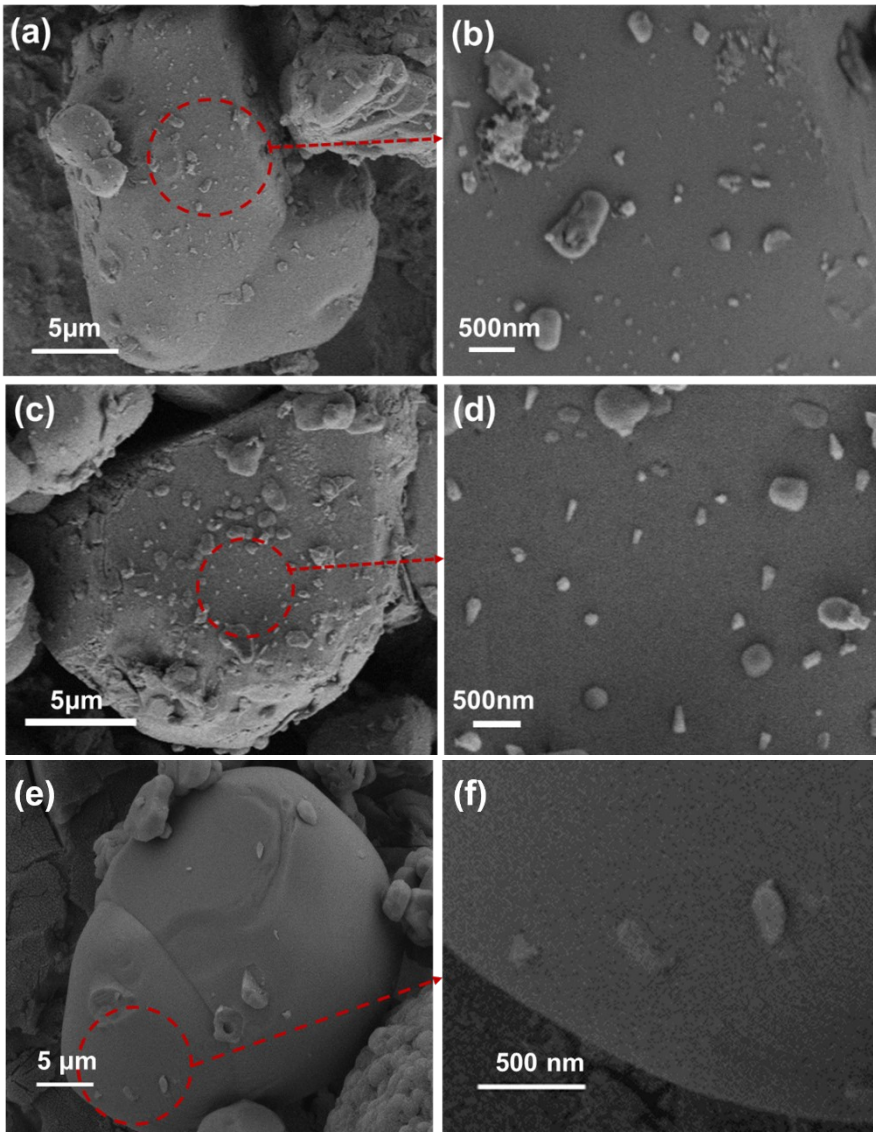


Fig.S2 SEM images of (a-b) LP-1, (c-d) LP-2 and (e-f) LP-4

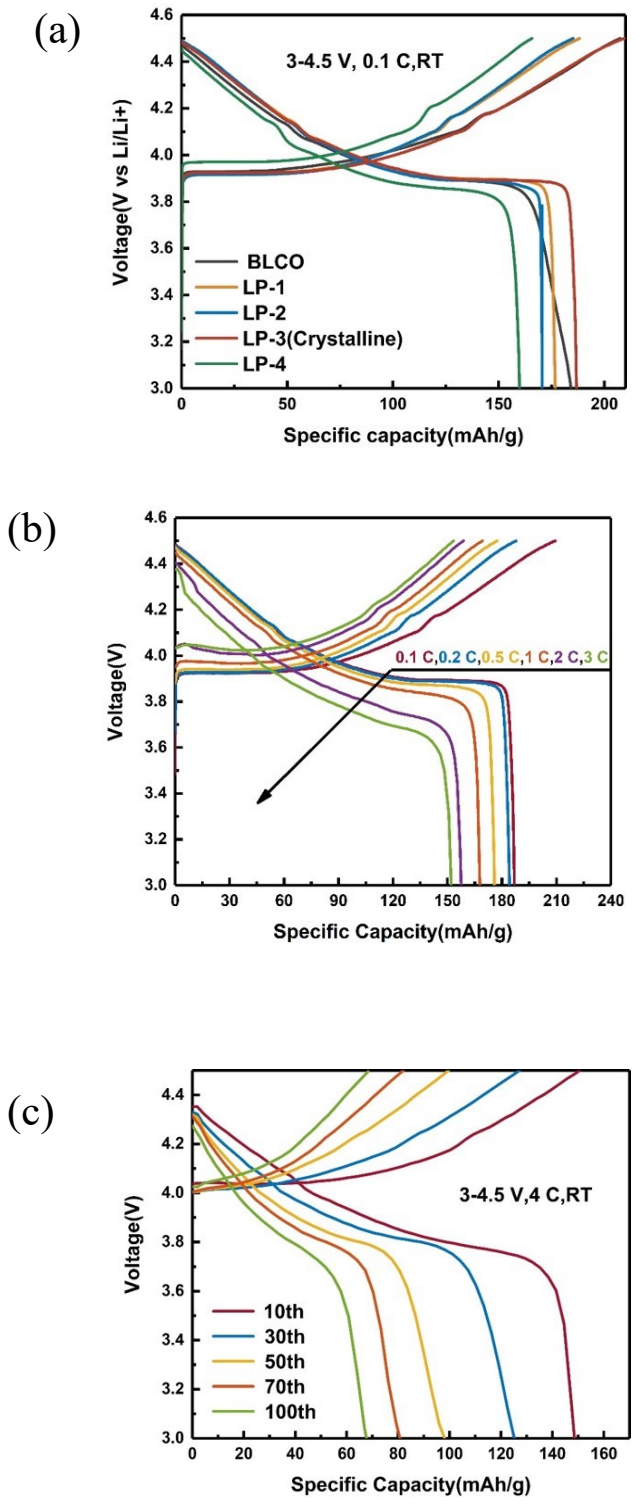


Fig. S3 (a) The initial charge and discharge curves, (b) The charge and discharge curves of LP-3 at different rates, (c) The charge and discharge profiles of LP-3 at 4 C.

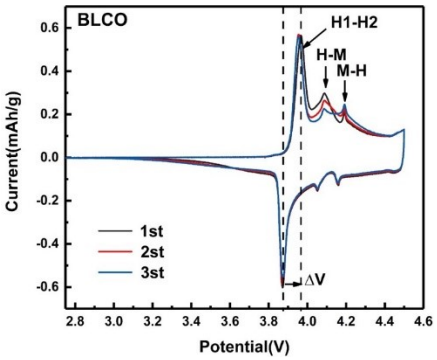
Tables1 The discharge capacity retention of BLCO and LCO@LP

Cathodes	Initial discharge capacity (mA h g^{-1})	100th discharge capacity (mA h g^{-1})	Capacity retention (%)
BLCO	158	60	37%
LP-1	176	156	88%
LP-2	168	152	89%
LP-3 (Crystalline)	181	163	90%
LP-4	160	84	52%

TablesS2 The discharge capacity of BLCO and LCO@LP at different rate

Cathodes	Discharge Capacity(mA h g^{-1})					
	0.1 C	0.2 C	0.5 C	1 C	2 C	3 C
BLCO	200	206	186	149	140	95
LP-1	176	175	169	162	153	147
LP-2	171	171	166	160	153	146
LP-3 (Crystalline)	188	184	175	168	158	152
LP-4	161	160	143	125	107	95

(a)



(b)

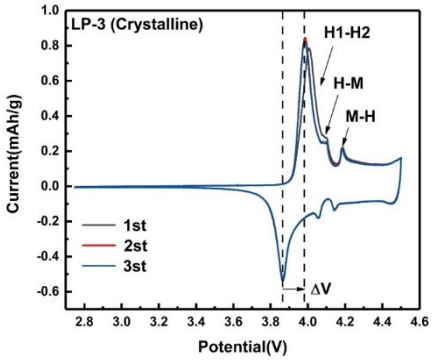


Fig. S4 (a-b) The cyclic voltammetry (CV) curves of BLCO and LP-3;

Table S3 EIS parameters of BLCO and LCO@LP

Cathodes	R_s(Ω)	R_{ct}(Ω)
BLCO	0.326	72.2
LP-1	2.14	48
LP-2	2.15	122
LP-3(Crystalline)	0.907	108
LP-4	0.38	164

Table S4 The comparison between the reported coating and this work

Cathode material	Initial Capacity (mA h g^{-1})	Ultimate capacity(cycle Number)/retention	Current density (mA/g)	Voltage range (V vs. Li/Li^+)	Ref
Li_3PO_4@LCO	185	146（100th）/80%	140	3-4.5	[30]
$AlPO_4$@LCO	190	176(100th)/92.6%	0.1 C	2.75-4.5	[29]
$LiCoPO_4$@LCO	171	153(50th)/89.4%	180	3-4.5	[49]
$LiMgPO_4$@LCO	175	160(50th)/91%	0.5 mA/cm^2	3-4.5	[31]
$Li_4Ti_5O_{12}$	180	156(100th)/86.7%	90	3-4.5	[37]
Li_3VO_4	162	87(100th) /86%	30	3.0–4.5	[50]
Li_2ZrO_3	172	101(100th)/85%(5 C)	0.5 C	3.0–4.5	[38]
$Li_{1.3}Al_{0.3}Ti_{1.7}(PO_4)_3$	182	160(50th)/88%	0.5 mA/cm^2	3.0–4.5	[51]
Li_3PO_4@LCO (by coprecipitation)	181	163(100th)/90% 141（200th）/76%	0.5 C	3-4.5	Ours