Supporting Information

Surface Phosphation of 3D Mesoporous $NiCo_2O_4$ Nanowire Arrays as a Bifunctional Anode for Lithium and Sodium Ion Battery

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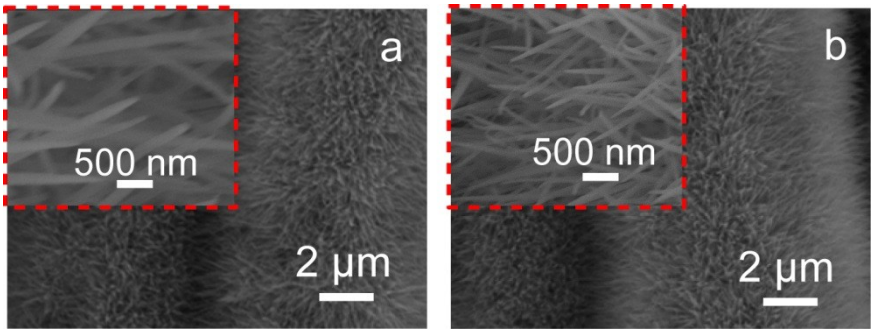

Fig. S1 SEM images of (a) $NiCo_2O_4$ NWAs, (b) P-$NiCo_2O_4$ NWAs.

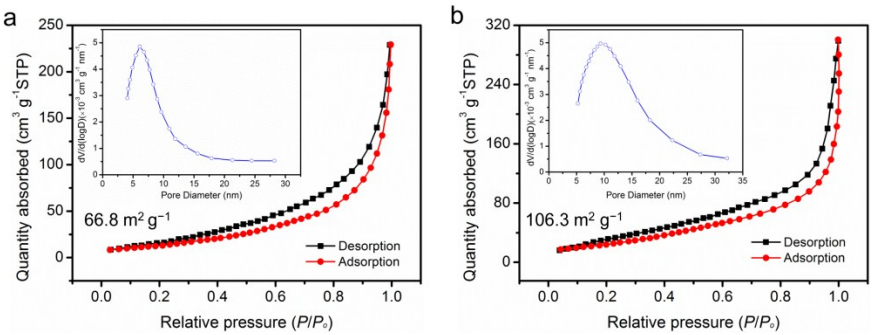

Fig. S2 N_2 adsorption-desorption isotherm of the $NiCo_2O_4$ NWAs (a) and P-$NiCo_2O_4$ NWAs (b). The inset is the corresponding pore size distribution.

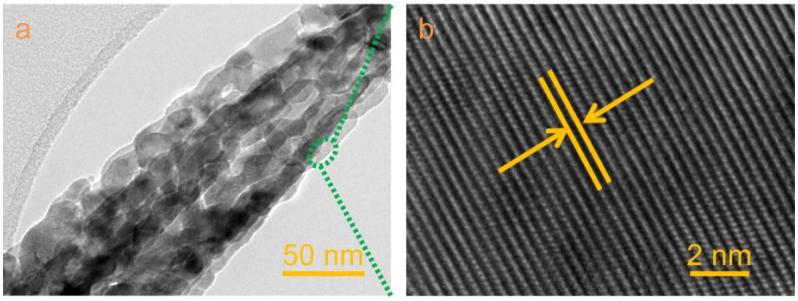

Fig. S3 (a) TEM, (b) HRTEM images of pristine $NiCo_2O_4$ NWAs. (b) is lattice-resolved TEM image of selective area in the region marked with a green dotted circle.

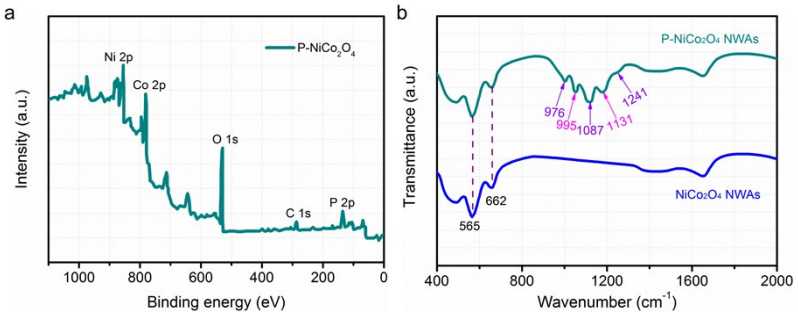

Fig. S4 (a) XPS survey spectra of P-$NiCo_2O_4$ NWAs. (b) FTIR spectra of $NiCo_2O_4$ NWAs and P-$NiCo_2O_4$ NWAs. Both tests were scratched down from the Ni foam.

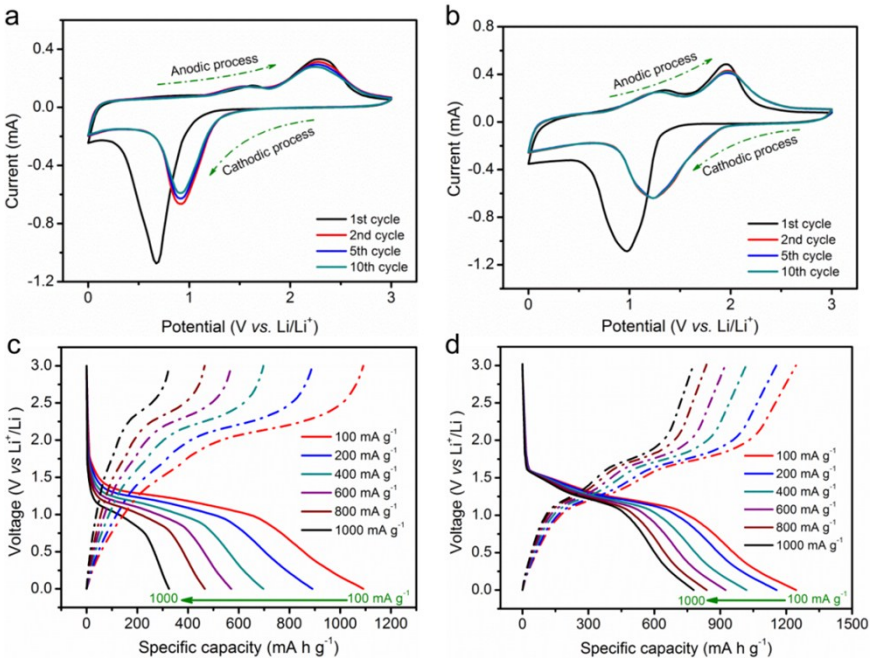

Fig. S5 (a, b) 1st, 2nd, 5th, 10th CV curves at the scanning rate of 0.2 mV s^{-1} of $NiCo_2O_4$ NWAs and P-$NiCo_2O_4$ NWAs electrode, respectively; (c, d) Charge/discharge curves at different rates of $NiCo_2O_4$ NWAs and P-$NiCo_2O_4$ NWAs electrode, respectively.

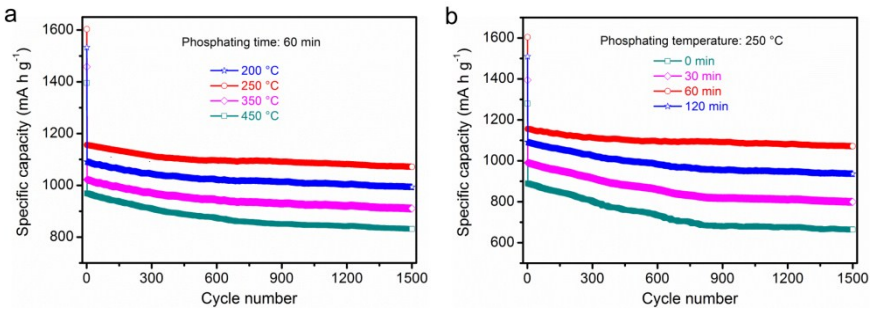

Fig. S6 Cycling performance collected at 200 mA g^{-1} of P-$NiCo_2O_4$ NWAs electrode with different phosphating temperature (a) and different phosphating time (b).

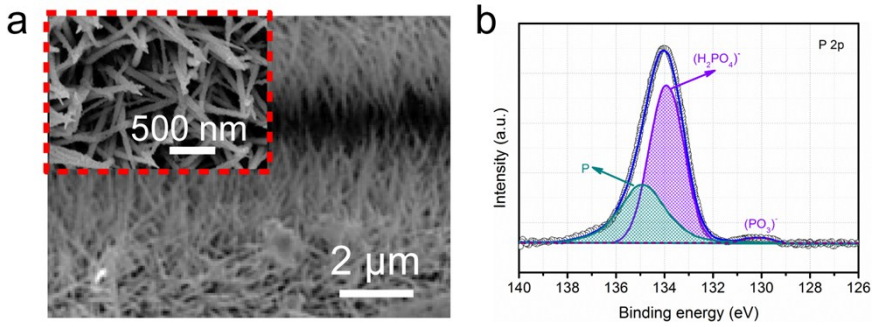

Fig. S7 (a) SEM image and (b) P 2p core-level XPS spectrum of the P-$NiCo_2O_4$ NWAs electrode after 1500 cycles for LIBs.

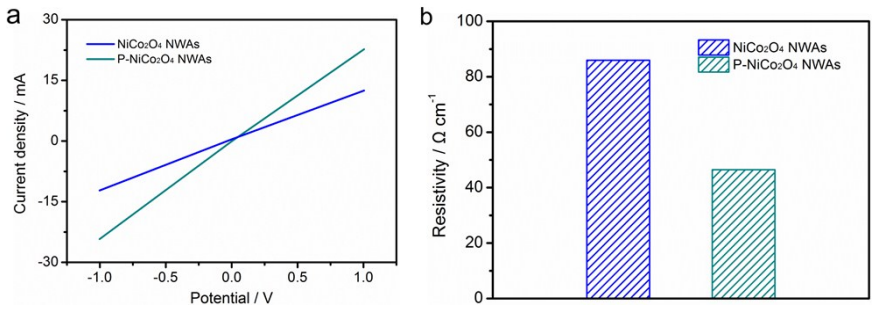

Fig. S8 (a) Linear sweep voltammetry curves at 10 mV s^{-1} and (b) calculated linear resistivities of the $NiCo_2O_4$ NWAs and P-$NiCo_2O_4$ NWAs electrodes.

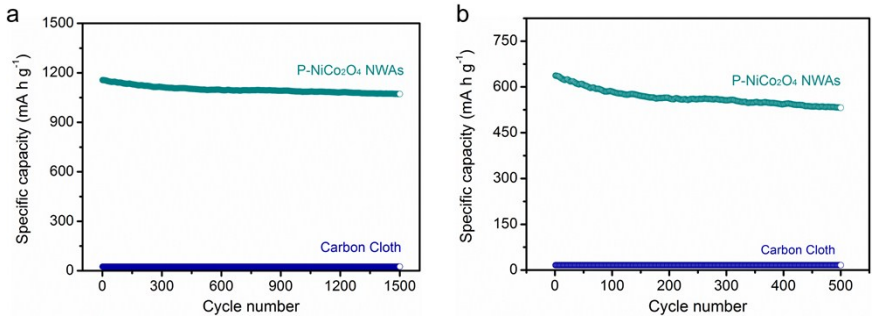

Fig. S9 Long cycling test of the P-$NiCo_2O_4$ NWAs and carbon cloth for (a) Li storage and (b) Na storage 200 mA g^{-1}.

Table S1. Comparison of lithium storage performance of different $NiCo_2O_4$ electrodes.

Type of material	Capacity (mA h g^{-1})	Rate performance	Cyclability (cycles)	Ref.
P-$NiCo_2O_4$ NWAs	1156 (200 mA g^{-1})	62.6% (100 to 1000 mA g^{-1})	91.7% (1500)	This work
$NiCo_2O_4$–C nanorods	1150 (100 mA g^{-1})	57% (100 to 2000 mA g^{-1})	79.8% (200)	[1]
$NiCo_2O_4$ nanosheets	1149 (100 mA g^{-1})	42.3% (100 to 1000 mA g^{-1})	86% (50)	[2]
$NiCo_2O_4$ microflowers	1127 (200 mA g^{-1})	41% (100 to 1600 mA g^{-1})	75.2% (60)	[3]
rGO/$NiCo_2O_4$	1095 (200 mA g^{-1})	35.7% (100 to 1000 mA g^{-1})	81.7% (500)	[4]
$NiCo_2O_4$/carbon textiles	1053 (200 mA g^{-1})	58.7% (200 to 3000 mA g^{-1})	84% (100)	[5]
$NiCo_2O_4$@SnO_2 @C	1016 (100 mA g^{-1})	31.7% (100 to 1000 mA g^{-1})	55.6% (100)	[6]
$NiCo_2O_4$	1003 (200 mA g^{-1})	31% (100 to 1600 mA g^{-1})	61.6% (500)	[7]
$NiCo_2O_4$ nanorods	1002 (100 mA g^{-1})	44.9% (100 to 2000 mA g^{-1})	67.7% (150)	[8]
$NiCo_2O_4$–RGO	974 (100 mA g^{-1})	41% (100 to 800 mA g^{-1})	80.1% (70)	[9]
Flower-like $NiCo_2O_4$	958 (150 mA g^{-1})	46.3% (150 to 2000 mA g^{-1})	82% (60)	[10]
$NiCo_2O_4$ hollow spheres	931 (150 mA g^{-1})	57% (150 to 2000 mA g^{-1})	78% (100)	[11]
$NiCo_2O_4$@$NiCo_2O_4$ NCA	925 (120 mA g^{-1})	44% (120 to 960 mA g^{-1})	89.7% (100)	[12]
$NiCo_2O_4$ NWAs	912 (200 mA g^{-1})	15% (100 to 1000 mA g^{-1})	27.1% (50)	[13]
Plum-like $NiCo_2O_4$	838 (100 mA g^{-1})	62.6% (100 to 1000 mA g^{-1})	96% (50)	[14]
UNF@$NiCo_2O_4$	815 (100 mA g^{-1})	50.2% (100 to 800 mA g^{-1})	76.4% (100)	[15]

Table S2. Comparison of sodium storage performance of different $NiCo_2O_4$ electrodes.

Type of material	Capacity (mA h g^{-1})	Rate performance	Cyclability (cycles)	Ref.
P-$NiCo_2O_4$ NWAs	687 (100 mA g^{-1})	54.5% (100 to 1000 mA g^{-1})	83.5% (500)	This work
$NiCo_2O_4$-NBs	635 (50 mA g^{-1})	No data	51.6% (30)	[16]
$NiCo_2O_4$-UNSs	610 (100 mA g^{-1})	24.6% (100 to 1000 mA g^{-1})	32.4% (50)	[17]
$NiCo_2O_4$	594 (100 mA g^{-1})	41.5% (50 to 500 mA g^{-1})	No negligible	[18]
$NiCo_2O_4$@CFC	547 (100 mA g^{-1})	47.7% (50 to 400 mA g^{-1})	81% (50)	[19]
$NiCo_2O_4$ microrods	431 (100 mA g^{-1})	30.3% (100 to 1000 mA g^{-1})	No data	[20]
$NiCo_2O_4$@G	405 (100 mA g^{-1})	28.2% (100 to 3200 mA g^{-1})	95% (100)	[21]
$NiCo_2O_4$	395 (50 mA g^{-1})	75.6% (50 to 400 mA g^{-1})	67.8% (50)	[22]
C@SnO_x/Cu	893 (50 mA g^{-1})	29.3% (50 to 1000 mA g^{-1})	86.5% (100)	[23]
SnO-2L	743 (100 mA g^{-1})	53.5% (100 to 2000 mA g^{-1})	76% (100)	[24]
C@SnS/SnO_2@Gr	726 (30 mA g^{-1})	42.3% (30 to 7290 mA g^{-1})	73.8% (500)	[25]
Fe_2O_3/rGO	613 (50 mA g^{-1})	34% (50 to 2000 mA g^{-1})	71.2% (100)	[26]
SnO_2/CNT	323 (100 mA g^{-1})	53.3% (100 to 1600 mA g^{-1})	63.5% (100)	[27]
TiO_2/C nanofiber	254 (50 mA g^{-1})	64.8% (50 to 2000 mA g^{-1})	84% (1000)	[28]
MoO_{3-x}	165 (50 mA g^{-1})	48.6% (50 to 1000 mA g^{-1})	No negligible	[29]
rGO–TiO_2	128 (20 mA g^{-1})	44.7% (50 to 4000 mA g^{-1})	69.8% (300)	[30]

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