Supplementary Materials

Zeolitic Imidazolate Framework-67-Derived Chalcogenides as Electrode Materials for Supercapacitor

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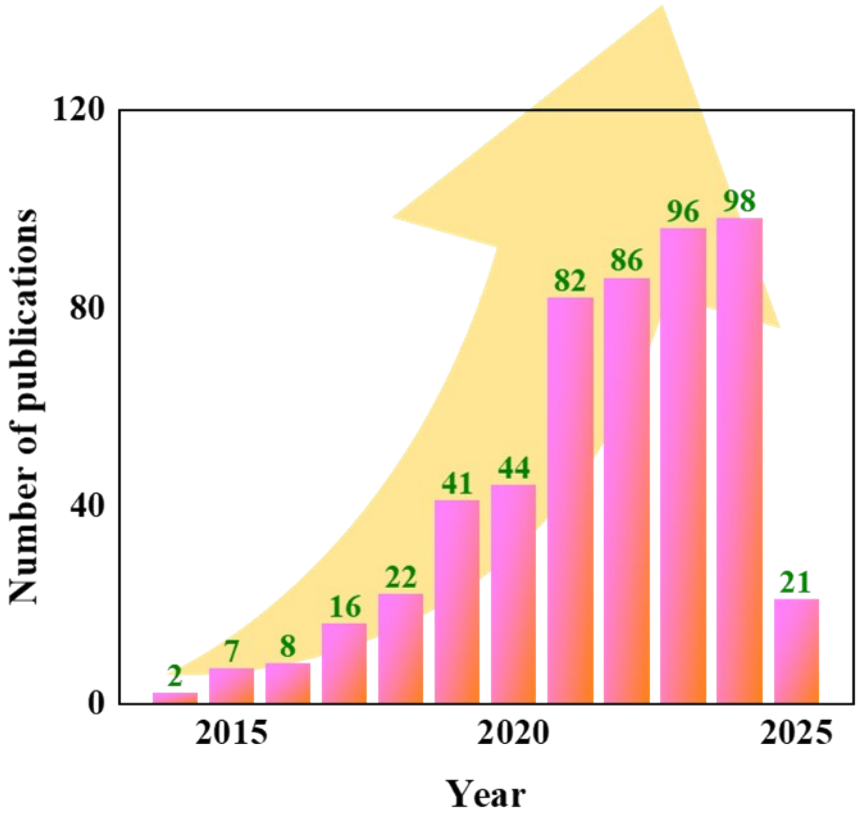

Figure S1. A relevant number of publications about ZIF-67 used for supercapacitors in Web of Science Core Collection. Data were taken in March 2025.

Table S1. Summary of the electrochemical characteristics of the pristine ZIF-67 materials in three-electrode measurements.

Electrode Materials	Specific Capacity	Electrolyte	Potential Window (CV)	Capacity Retention	Cyclic stability	Ref.
PANI-ZIF-67-CC	2146 mF cm^{-2} at 10 mV s^{-1}	3 M KCl	-0.2-1 V (Ag/AgCl)	42% (10 to 100 mV s^{-1})		1
PANI-CNT@ZIF-67-CC	3511 mF cm^{-2} at 10 mV s^{-1}	0.1 M aniline + 3 M KCl	-0.2-1 V (SCE)		83% (1000)	2
Ni/Co-MOF	530.4 F g^{-1} at 0.5 A g^{-1}	1 M LiOH	0-0.5 V (Ag/AgCl)		99.75% (2000)	3
ZIF-PPy-2	554.4 F g^{-1} at 0.5 A g^{-1}	1 M Na_2SO_4	0-0.6 V (Ag/AgCl)	43.8% (0.5 to 20 A g^{-1})	90.7% (10000)	4
POAP/ZIF-67	724 F g^{-1} at 0.005 mA	0.1 M $HClO_4$	-0.5-0.5 V		90% (1000)	5
ZIF-67/rGO	1453 F g^{-1} at 4.5 A g^{-1}	RAE	-0.1-0.5 V (Ag/AgCl)		90.5% (1000)	6
ZIF-67/GO-n	70.76 F g^{-1} at 1 A g^{-1}	6 M KOH	-0.3-0.4 V(SCE)	65.5% (1 to 20 A g^{-1})	150% (1000)	7
TC-ZIF-67	1756 mF cm^{-2} at 2 mA cm^{-2}	2 M KOH	0-0.55 V (Ag/AgCl)	76% (2 to 50 mA cm^{-2})	103% (15000)	8
Co/Mn-ZIF	926.25 F g^{-1} at 0.5 A g^{-1}	3 M KOH	0-0.4 V (Hg/HgO)	29% (0.5 to 5 A g^{-1})	64.1% (1500)	9
MOF-PPy/PDA/BC	1.71 F cm^{-2} at 0.4 mA cm^{-2}	1 M H_2SO_4	0-0.8 V (SCE)	59.8% (0.4 to 20 mA cm^{-2})	71.04% (5000)	10
$PMo_{10}V_2$@ZIF-67	475 F g^{-1} at 2 A g^{-1}	3 M KOH	0-0.4 V (SCE)	76% (2 to 10 A g^{-1})		11
ZIF-67@Amorphous ZIF	1176.9 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.6 V (SCE)	52.4% (1 to 20 A g^{-1})	98% (1000)	12
Ni_{33}/ZIF-67/rGO_{20}	304.2 F g^{-1} at 1 A g^{-1}	1 M H_2SO_4	-0.2 0.8 V (Ag/AgCl)		98.9% (1000)	13
ZIF-67/PEDOT	106.8 F g^{-1} at 1 A g^{-1}	1 M H_2SO_4	0-0.5 V (Ag/AgCl)	46.7% (5 to 100 mV s^{-1})	85% (2000)	14
NiV LDH@ZIF-67	830.6 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.6 V (Ag/AgCl)	61.6% (1 to 20 A g^{-1})		15
ZIF-67@PANI	2497 F g^{-1} at 1 A g^{-1}	1 M KOH	-0.5-0.7 V (Ag/AgCl)	57.7% (1 to 10 A g^{-1})	92.3% (9000)	16
M-ZIF-67@LDH	597.6 F g^{-1} at 0.5 A g^{-1}	3 M KOH	0-0.6 V (Hg/HgO)	68% (0.5 to 10 A g^{-1})	92% (5000)	17
$NH_4Co_xNi_{1-x}F_3$	490.4 F g^{-1} at 20 mV s^{-1}	3 M KOH	-0.3-0.7 V (Ag/AgCl)	94% (2.5 to 4 A g^{-1})		18
$MnFe_2O_4$/CNT/ZIF	389 F g^{-1} at 1 A g^{-1}	3 M KOH	-0.55-0.3 V (Ag/AgCl)	1% (0.5 to 10 A g^{-1})	107% (500)	19
α-$CoMn_{0.05}(OH)_x$/ZIF-67	689 F g^{-1} at 0.5 A g^{-1}	3 M KOH	0-0.5 V (Hg/HgO)			20
Co-ZIF-R3	86 C g^{-1} at 0.25 A g^{-1}	1 M KOH	-0.1-0.45 V (Ag/AgCl)		85% (1000)	21
N-ZIF-67.rGO	962 F g^{-1} at 20 mA cm^{-2}	2 M KOH	0-0.6 V (SCE)		97% (1000)	22
ZIF-7@ZF-67	518.9 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.4 V (Ag/AgCl)	74.2% (1 to 20 A g^{-1})	99.6% (4000)	23
$NH_4Co_xNi_{1-x}F_3$	735.7 F g^{-1} at 20 mV s^{-1}	3 M KOH	-0.15-0.55 V (Ag/AgCl)	86% (10 to 50 mV s^{-})		24
CFP/ZIF-L/PANI	730 mF cm^{-2} at 10 mV s^{-1}	0.1 M aniline + 3 M KCl	-0.2-0.8 V (Ag/AgCl)		82.6% (3000)	25
ZADV@LSC	250.1 F g^{-1} at 0.8 A g^{-1}	1 M Na_2SO_4	-0.2-0.6 V (Ag/AgCl)			26
Graphene@ZIF-67/PANI-NT	20.4167 F g^{-1} at 0.5 mA cm^{-2}	1 M Na_2SO_4	0-0.8 V (Ag/AgCl)	36.7% (0.05 to 1 mA cm^{-2})	75% (3000)	27
ZIF-67/rGO/NiPc	860 F g^{-1} at 1 A g^{-1}	3 M KOH	0-0.8 V (SCE)	47.4% (1 to 10 A g^{-1})	95.1% (5000)	28
ZIF-67@ZIF-9	300 F g^{-1} at 3 A g^{-1}	6 M KOH	-0.05-0.45 V (Ag/AgCl)	54.7% (3 to 100 A g^{-1})		29

ZIF-90@ZIF-67	1357.8 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.6 V (SCE)	55.4% (1 to 20 A g^{-1})	90.1% (4000)	30
CPYF-ZIF-67-PPy	2308.8mF cm^{-2} at 0.5mA cm^{-2}	1 M Na_2SO_4	0-0.8 V (Ag/AgCl)	67.1% (1 to 15 A g^{-1})	87.6% (10000)	31
ST@ZIF-67/MnO_2	278.6 F g^{-1} at 0.5 A g^{-1}	1 M Na_2SO_4	0-1 V (SCE)	70.3% (0.5 to 10 A g^{-1})	80.3% (10000)	32
Co-ZIF-67@NiMo-LDH	1734 F g^{-1} at 1 A g^{-1}	3 M KOH	0-0.5 V (SCE)	80% (1 to 10 A g^{-1})	88% (5000)	33
Ru/ZIF-67	1503.33 F g^{-1} at 1 A g^{-1}	1 M KOH	0-0.6 V (Hg/HgO)			34
NiCo-MOF@CoOOH@V_2O_5	605.49 F g^{-1} at 0.5 A g^{-1}	3 M KOH	0-0.5 V (Hg/HgO)	51.6% (0.5 to 20 A g^{-1})		35
ZIF-67/LIG	135.6 mF cm^{-2} at 1 mA cm^{-2}	1 M Na_2SO_4	-0.25-0.75 V (SCE)	51.4% (1 to 5 mA cm^{-2})		36
NiTe/ZIF-67	1521 F g^{-1} at 1 A g^{-1}	1 M KOH	0-0.6 V (SCE)		93.5% (5000)	37
ZIF-67@Cu_2CoO_3	117.5 mAh g^{-1} at 1 mA cm^{-2}	1 M KOH	0-0.5 V (Ag/AgCl)		83.4% (25000)	38
VAGC/ZIF-67	1674 F g^{-1} at 2 A g^{-1}	6 M KOH	-0.2-0.6 V (Hg/HgO)	38.9% (2 to 10 A g^{-1})	67% (4500)	39
Ni-BTC@ZIF-67	1063 F g^{-1} at 4 A g^{-1}	5 M KOH	0-0.48 V (Ag/AgCl)		98% (5500)	40
ZIF8@ZIF67	1521 F g^{-1} at 1 A g^{-1}	1 M KOH	0.1-0.6 V (Hg/HgO)	38.5% (1 to 13 A g^{-1})		41
ZIF-67	377.88 F g^{-1} at 2 A g^{-1}	6 M NaOH	0-0.55 V (Ag/AgCl)	54.7% (2 to 20 A g^{-1})	118.2% (5000)	42
ZnO/ZIF-67	2908 F g^{-1} at 1 A g^{-1}	2 M KOH	-0.3-0.9 V (Ag/AgCl)		95.3% (5000)	43
A-ZCo@NF	5603 mF cm^{-2} at 5 mA cm^{-2}	3 M KOH	0-0.5 V (Hg/HgO)	78.6% (5 to 50 mA cm^{-2})	89.18% (10000)	44
Co-ZIF-67/Ni-CNT@NiLa-LDH	1710 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.5 V (Hg/HgO)	38.1% (1 to 10 A g^{-1})	73.3% (10000)	45
G/PANI-NT/ZNC	62.1 C g^{-1} at 10 mV s^{-1}	1 M Na_2SO_4	0-0.8 V (Ag/AgCl)	57.6% (10 to 100 mV s^{-1})	92.2% (8000)	46
ZIF-67/NiS	1157.1 F g^{-1} at 10 A g^{-1}	1 M KOH	-1-1 V (Ag/AgCl)		87% (4000)	47
S-Ni/ZIF-67@RGO	1142.3 F g^{-1} at 1 A g^{-1}	1 M KOH	0-0.5 V (Ag/AgCl)	46.6% (1 to 20 A g^{-1})	90.8% (3000)	48
CoMn-LDH/ZIF-67/PANI	1048 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.6 V (Hg/HgO)	61.07% (1 to 10 A g^{-1})	80.5% (5000)	49
ZF-NS/g-C_3N_4	625 F g^{-1} at 3 A g^{-1}	1 M KOH	-1-0.45 V (Ag/AgCl)	62.4% (3 to 15 A g^{-1})	142% (7000)	50
ZIF-67	472 F g^{-1} at 3 A g^{-1}	6 M NaOH	0-0.55 V (Ag/AgCl)	76.5% (3 to 12 A g^{-1})	91.6% (5000)	51
ZIF-8@ZIF-67	263.43 F g^{-1} at 0.5 A g^{-1}	1 M H_2SO_4	0-1 V (Ag/AgCl)		112% (4500)	52
ZIF-67/CFC	1470 mF cm^{-2} at 1 mA cm^{-2}	1 M LiOH	0-0.6 V (Hg/HgO)	89% (1 to 8 mA cm^{-2})	91% (10000)	53
V_2O_5@ZIF-67	913.06 F g^{-1} at 6 A g^{-1}	6 M KOH	0-0.5 V (Hg/HgO)	52% (6 to 40 A g^{-1})	78.37% (10000)	54
CCNF-20@MOF	361.5 C g^{-1} at 0.5 A g^{-1}	3 M KOH	0-0.7 V (Hg/HgO)	32.27% (0.5 to 10 A g^{-1})		55
CoTe/ZIF-67	2021 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.6 V (SCE)	60% (1 to 20 A g^{-1})	95% (10000)	56

Table S2. Summary of the electrochemical characteristics of the ZIF-67-derived carbon materials in three-electrode measurements.

Electrode Materials	Specific Capacity	Electrolyte	Potential Window (CV)	Capacity Retention	Cyclic stability	Ref.
NPC-800	238 F g^{-1} at 20 mV s^{-1}	0.5 M H_2SO_4	0-0.8 V (Ag/AgCl)	72% (20 to 200 mV s^{-1})		57
Carbon-ZS	285.8 F g^{-1} at 0.1 A g^{-1}	6 M KOH	-1-0 V (Hg/HgO)	72.8% (0.1 to 2 A g^{-1})	97.8% (1000)	58
Cobalt/carbon composites	512 F g^{-1} at 1 A g^{-1}	1 M KOH	0.5-1.1 V (SCE)	46.4% (1 to 20 A g^{-1})	87.5% (1000)	59
Carbon-ZSR	305 F g^{-1} at 1 A g^{-1}	1 M H_2SO_4	-0.2-0.8 V (SCE)	75% (1 to 10 A g^{-1})	98.4% (5000)	60
HCN-650	343 F g^{-1} at 10 mV s^{-1}	6 M KOH	-0.8-0.2 V (Ag/AgCl)	58% (0.5 to 2 A g^{-1})		61
NiCo-C-1	2471 F g^{-1} at 1 A g^{-1}	2 M KOH	0-0.7 V (Ag/AgCl)		88% (5000)	62
CoNi-carbon	236 F g^{-1} at 1 A g^{-1}	6 M KOH	-0.2-0.3 V (Ag/AgCl)	50.8% (1 to 10 A g^{-1})	94.3% (1000)	63
Co_3O_4/NC-90-15	1.22 F cm^{-2} at 0.5 mA cm^{-2}	6 M KOH	0-0.6 V (Hg/HgO)	60% (0.5 to 20 mA cm^{-2})	98.2% (4000)	64
NCMO	389 F g^{-1} at 1 A g^{-1}	1 M Na_2SO_4	0-1.2 V (Hg/HgO)	66% (1 to 15 A g^{-1})	93.8% (10000)	65
NSCPCNF	396 F g^{-1} at 1 A g^{-1}	1 M H_2SO_4	0-1 V (Ag/AgCl)	67% (1 to 20 A g^{-1})		66
RPCF/CC	1049 mF cm^{-2} at 12 mA cm^{-2}	1 M Na_2SO_4	-1.5-0 V (SCE)	69% (12 to 60 mA cm^{-2})	98.4% (6000)	67
Fe_3O_4/C	868.7 C g^{-1} at 2 A g^{-1}	3 M KOH	-0.9-0.45 V (Hg/HgO)	52.5% (2 to 20 A g^{-1})	88.8% (3000)	68
NFHPC	305 F g^{-1} at 1 A g^{-1}	3 M KOH	-1-0 V (Hg/HgO)	76.7% (1 to 20 A g^{-1})	95.1% (5000)	69
ZIF-67-C-KOH	262.4 F g^{-1} at 1 A g^{-1}	1 M KOH	-1-0 V (Hg/HgO)	82% (1 to 10 A g^{-1})		70
CCSs	320 F g^{-1} at 1 A g^{-1}	2 M H_2SO_4	0-0.8 V (SCE)	74% (1 to 10 A g^{-1})	106% (10000)	71
Co@C	652 F g^{-1} at 1 A g^{-1}	3 M KOH	-0.6-0.4 V (Hg/HgO)		97.1% (20000)	72
N-doped carbon	277 C g^{-1} at 1 A g^{-1}	6 M KOH	-1-0 V (Hg/HgO)			73
MnO_2/Carbon-CNTs	508.8 F g^{-1} at 0.5 A g^{-1}	2 M KOH	-0.25-0.55 V	52.6% (0.5 to 10 A g^{-1})	90% (5000)	74
N-Co/CNF	433 F g^{-1} at 0.2 A g^{-1}	1 M H_2SO_4	0-0.5 V (SCE)	70% (0.2 to 1 A g^{-1})	84% (3000)	75
HT-Ag/ZIF(H)	135.5 C g^{-1} at 1 A g^{-1}	6 M KOH	-0.1-0.5 V (SCE)	66% (1 to 15 A g^{-1})		76
NF@CoO@Co/N-C	1693.4 F g^{-1} at 2 mA cm^{-2}	6 M KOH	0-0.5 V (Hg/HgO)	91.3% (2 to 20 mA cm^{-2})		77
Gr-CNT@Co	1108 F g^{-1} at 1 A g^{-1}	2 M KOH	0-0.7 V (Hg/HgO)	81% (1 to 10 A g^{-1})	75% (6000)	78
C@ZIF-67-600	1044.8 F g^{-1} at 1 A g^{-1}	3 M KOH	0-0.5 V (Hg/HgO)	40% (1 to 20 A g^{-1})	89% (30000)	79
rGO/NPC-10	190 F g^{-1} at 0.5 A g^{-1}	1 M H_2SO_4	0-1 V (Ag/AgCl)	83.6% (0.5 to 5 A g^{-1})	97.2% (2500)	80
NC@GC/CNTs		1 M NaCl	-1-0 V (Ag/AgCl)			81
NiS@Co-NC	1116.6 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.5 V (SCE)	71.8% (1 to 8 A g^{-1})	90.177% (5000)	82
N-$Ti_3C_2T_x$/C/CuS	1205.8 F g^{-1} at 1 A g^{-1}	1 M KOH	-1- 0.55 V (Hg/HgO)			83
g-C_3N_4@ZIF-67	657 F g^{-1} at 1 A g^{-1}	2 M KOH	-0.01-0.55 V (Ag/AgCl)	40.6% (1 to 20 A g^{-1})	90% (3500)	84
CAT@ZIF-67-NC	133.4 F g^{-1} at 5 mV s^{-1}	6 M KOH	-0.8-0 V (Ag/AgCl)	58% (5 to 200 mV s^{-1})		85
CuFe/N-C@Co/N-CNTs@GO	493 F g^{-1} at 1 A g^{-1}	1 M KOH	0-0.6 V (Ag/AgCl)	51.9% (1 to 10 A g^{-1})		86
Carbonized Wood@ZIFs	5155.3 mF cm^{-2} at 2.5mA cm^{-2}	3 M KOH	-0.8-0 V (Ag/AgCl)	47.3% (2.5 to 20 mA cm^{-2})		87
Bi_2S_3/C	419 F g^{-1} at 1 A g^{-1}	2 M KOH	-1-0 V (Hg/HgO)		72.2% (1000)	88
$CoMnO_x$@ZIFC	963 F g^{-1} at 1 A g^{-1}	2 M KOH	-0.2-0.6 V (Ag/AgCl)	63.8% (1 to 10 A g^{-1})	93.72% (1000)	89
NC-VG-CC	201 F g^{-1} at 5 A g^{-1}	2 M KOH	-1-0 V (Hg/HgO)	60% (5 to 50 A g^{-1})		90
NiCo-LDH@C	2210.6 F g^{-1} at 1 A g^{-1}	2 M KOH	0-0.6 V (SCE)	88.8% (1 to 10 A g^{-1})	86.3% (10000)	91

CNS/CNP-2	588 F g^{-1} at 1 A g^{-1}	3 M KOH	0-0.55 V (Hg/HgO)		94% (8000)	[92]
Co@NPC/MX	1605 F g^{-1} at 5 mV s^{-1}	3 M H_2SO_4	-0.6-0.25 V (Ag/AgCl)	66% (5 to 100 mV s^{-1})	94.5% (5000)	[93]
CZIF-67-CNTs	103.3 F g^{-1} at 0.2 A g^{-1}	2 M $ZnSO_4$	0.3-1.8 V (Zn)		74% (2000)	[94]
CNF@CoNi(1:4)S	617.78 F g^{-1} at 0.5 A g^{-1}	3 M KOH	0-0.7 V (Hg/HgO)	58.27% (0.5 to 5 A g^{-1})	71.94% (1000)	[95]
Co_4N/C	312.96 F g^{-1} at 1.5 A g^{-1}	1 M H_2SO_4	-0.8-0 V (Ag/AgCl)	38.2% (1.5 to 6 A g^{-1})		[96]
Cu_2S/C@NiMnCe-LDH/CF	5176.4 mF cm^{-2} at 2 mA cm^{-2}	6 M KOH	0-0.5 V (Hg/HgO)		84.11% (8000)	[97]
bamboo@ZIF-67	24.7 F cm^{-2} at 1 mA cm^{-2}	6 M KOH	-1-0 V (Hg/HgO)	70.7% (5 to 30 mA cm^{-2})	90.5% (50000)	[98]

Table S3. Summary of the electrochemical characteristics of the ZIF-67-derived hydroxides materials in three-electrode measurements.

Electrode Materials	Specific Capacity	Electrolyte	Potential Window (CV)	Capacity Retention	Cyclic stability	Ref.
Ni-Co LDH-3	790 C g^{-1} at 2 A g^{-1}	1 M KOH	-0.2-0.65 V (Hg/HgO)	51.2% (1 to 10 A g^{-1})	82.9% (1000)	99
NCLDH@CNTs	916.8 C g^{-1} at 1 A g^{-1}	6 M KOH	-0.2-0.65 V (Hg/HgO)	82.7% (1 to 10 A g^{-1})	79.0% (4000)	100
rGO@NiClAl-LDHs	2291.6 F g^{-1} at 1 A g^{-1}	6 M KOH	-0.2-0.6 V (SCE)		92% (2000)	101
HIH-LDHs	156.4 mAh g^{-1} at 5 A g^{-1}	1 M KOH	0-0.5 V (Ag/AgCl)	70% (5 to 80 A g^{-1})	73.4% (10000)	102
H-NiCo LDH@ACC	3060 mF cm^{-2} at 1 mA cm^{-2}	1 M KOH	0-0.5 V (Ag/AgCl)	70% (1 to 80 mA cm^{-2})	99% (10000)	103
NiCoMn-OH	1654.5 F g^{-1} at 1 A g^{-1}	3 M KOH	-0.1-0.6 V (SCE)	58.5% (1 to 30 A g^{-1})	70.2% (2500)	104
α-Co/$Ni(OH)_2$@Co_3O_4-70	1000 F g^{-1} at 1 A g^{-1}	6 M KOH	0.1-0.6 V (Ag/AgCl)	74% (1 to 10 A g^{-1})	72.34% (8000)	105
α-Co/$Ni(OH)_2$@CQDs-X	700 C g^{-1} at 1 A g^{-1}	6 M KOH	0.97-1.47 V (Hg/HgO)	80% (1 to 10 A g^{-1})	79.93% (10000)	106
Ni-CCH@MnNiCo-OH	1029.3 C g^{-1} at 1 A g^{-1}	1 M KOH	-0.2-0.7 V (Hg/HgO)	62.4% (1.5 to 25 mA cm^{-2})	88% (3000)	70
Ni-Co LDH/rGO/NF	2505 F g^{-1} at 1 A g^{-1}	2 M KOH	0-0.5 V (Hg/HgO)	81% (1 to 20 A g^{-1})	54.7% (1000)	107
CoNi-LDH	1877 F g^{-1} at 1 A g^{-1}	6 M KOH	-0.2-0.45 V (Hg/HgO)	77.14% (1 to 10 A g^{-1})	99.89% (5000)	108
$(NiCo\text{-}LDH)S_{HH}$	1765 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.4 V (Hg/HgO)	69% (1 to 10 A g^{-1})	86% (5000)	109
OCS/NiCo-LDH@Ni foam	1784 F g^{-1} at 1 A g^{-1}	3 M KOH	-0.3-0.95 V (Hg/HgO)	41% (1 to 10 A g^{-1})	83.2% (6000)	110
PPy/Ni-Co LDH-X	1858.3 F g^{-1} at 1 mA cm^{-2}	1 M KOH	0-0.6 V (SCE)	65% (1 to 20 mA cm^{-2})	47% (100)	111
α-$Co(OH)_2$	87.1 mAh g^{-1} at 1 A g^{-1}	6 M KOH	0-0.55 V (Hg/HgO)	77% (1 to 20 A g^{-1})	100% (20000)	112
PNT@NiCo-LDH	1448.2 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.5 V (Hg/HgO)	44.8% (1 to 20 A g^{-1})		113
GO@$Co(OH)_2$/PANI	1014 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.6 V (SCE)	61% (1 to 10 A g^{-1})	80% (20000)	114
MXene/NiCoZDH	877 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.45 V (Hg/HgO)	79.1% (1 to 10 A g^{-1})	90.9% (30000)	115
CCO/Co-Ni-Mn LDH	2995.56 F g^{-1} at 1 A g^{-1}	2 M KOH	-0.1-0.6 V (SCE)	71.9% (1 to 10 A g^{-1})	91.8% (5000)	116
hollow Ni Co-LDH	1141.1 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.5 V (Hg/HgO)	70.1% (1 to 20 A g^{-1})	93.8% (5000)	117
HA-NiCo-LDH	1083 C g^{-1} at 0.5 A g^{-1}	6 M KOH	0-0.4 V (SCE)	52% (0.5 to 20 A g^{-1})	77% (10000)	118
α-$Ni_xCo_{(1-x)}(OH)_2$	2329.2 F g^{-1} at 1 A g^{-1}	2 M KOH	-0.2-0.6 V (SCE)	77% (1 to 20 A g^{-1})	80.4% (1000)	119
NiCo-LDH@MOF	723 C g^{-1} at 1 A g^{-1}	2 M KOH	0-0.6 V (Hg/HgO)	66% (1 to 30 A g^{-1})	72.5% (5000)	120
$CuBr_2$@NCC-LDH/CF	5460 mF cm^{-2} at 2 mA cm^{-2}	6 M KOH	0.1-0.5 V (Hg/HgO)	88% (2 to 50 mA cm^{-2})	88% (5000)	121
Ni-Co LDH	2369 F g^{-1} at 0.5 A g^{-1}	2 M KOH	0-0.6 V (Hg/HgO)	78.5% (0.5 to 10 A g^{-1})		122
NC-LDH/PNT	1280 F g^{-1} at 1 A g^{-1}	2 M KOH	0-0.6 V (Hg/HgO)	65% (1 to 20 A g^{-1})		123
Ni_2CoMn_1-LDH	1634.4 F g^{-1} at 0.5 A g^{-1}	3 M KOH	0-0.55 V (Hg/HgO)	63.6% (0.5 to 20 A g^{-1})	73.1% (2000)	124
N-GQD/H-NiCo-LDH	2347 F g^{-1} at 1 A g^{-1}	2 M KOH	0-0.7 V (Hg/HgO)	82% (1 to 10 A g^{-1})	81.1% (2000)	125
NiCo-LDH-210	2203.6 F g^{-1} at 2 A g^{-1}	3 M KOH	0-0.55 V (Hg/HgO)	86.8% (2 to 10 A g^{-1})	76.5% (2000)	126
NiCo-LDH-S/PNTs	1554.7 F g^{-1} at 7 A g^{-1}	3 M KOH	-0.1-0.5 V (Ag/AgCl)	95.8% (7 to 11 A g^{-1})		127
Co-Mn LDHs	714.7 F g^{-1} at 0.5 A g^{-1}	1 M KOH	-0.1-0.6 V (SCE)	67.4% (0.5 to 10 A g^{-1})	91.2% (4000)	128
Ni@NC@NiCo-LDH	1761.8 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.6 V (Hg/HgO)	61% (1 to 15 A g^{-1})	89.47% (20000)	129
NiCoMn-LDH/C	888.3 C g^{-1} at 1 A g^{-1}	2 M KOH	0-0.6 V (Hg/HgO)	85.16% (1 to 10 A g^{-1})	86.76% (5000)	130
V_2CT_x@NiCoMn-OH-20	827.45 C g^{-1} at 1 A g^{-1}	3 M KOH	0-0.5 V (Hg/HgO)	85.32% (1 to 10 A g^{-1})	88.44% (10000)	131
ZIF-67@Ni-salicylate	1493 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.5 V (Hg/HgO)	86.8% (1 to 40 A g^{-1})	53.2% (5000)	132
NiCo-LDH/rGO-30	829 C g^{-1} at 1 A g^{-1}	2 M KOH	0-0.6 V (SCE)	51% (1 to 8 A g^{-1})	69% (2500)	133

PEDOT@NiCo-LDH/CC	1508 F g^{-1} at 1 A g^{-1}	1 M KOH	0-0.5 V (Hg/HgO)	71.9% (1 to 20 A g^{-1})	90.1% (10000)	[134]
MnCoNi-LDH	2254 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.6 V (Hg/HgO)	69.2% (1 to 20 A g^{-1})	91.53% (5000)	[135]
INPC/NiCo-LDH	1714 F g^{-1} at 0.5 A g^{-1}	6 M KOH	0-0.5 V (Hg/HgO)	64% (0.5 to 10 A g^{-1})	86.1% (5000)	[136]
CuO@NiCo-LDH/CF	5607 mF cm^{-2} at 1 mA cm^{-2}	2 M KOH	-0.1-0.6 V (SCE)	88.3% (1 to 10 mA cm^{-2})	93.1% (5000)	[137]
CoNi@ZIF-LDH	1488 F g^{-1} at 1 A g^{-1}	2 M KOH	0-0.6 V	55.9% (1 to 20 A g^{-1})	83.87% (3000)	[138]
Ni1CoCu0.5-OH	1122.97 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.6 V (Hg/HgO)	85.1% (1 to 20 A g^{-1})	92.69% (10000)	[139]
NiCo-LDH/AgNWs/Cotton	823.9 mF cm^{-2} at 1 mA cm^{-2}	1 M KOH	0-0.4 V (Hg/HgO)		77% (1000)	[140]
CoFe-LDH	1824 F g^{-1} at 1 A g^{-1}	3 M KOH	0-0.5 V (Hg/HgO)	82% (1 to 5 A g^{-1})	91% (5000)	[141]
NiCo-LDH@HOS	1100 mF cm^{-2} at 2 mV s^{-1}	3 M KOH	0-0.5 V (Ag/AgCl)	54.5% (2 to 100 mV s^{-1})		[142]
Mo-doped NiCo-LDH	1368.4 C g^{-1} at 1 A g^{-1}	2 M KOH	0-0.6 V (SCE)	88.4% (1 to 10 A g^{-1})	88.8% (10000)	[143]
MnCoNi LDH@CoNi LDH	2126.7 F g^{-1} at 0.5 A g^{-1}	6 M KOH	0-0.5 V (Hg/HgO)	75.7% (0.5 to 5 A g^{-1})		[144]
IPC/NiCoMn-LDH	2236 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.5 V (Hg/HgO)	65.3% (1 to 10 A g^{-1})	85.9% (5000)	[145]
NMC-LDH/ZnO@CC	9258 mF cm^{-2} at 2 mA cm^{-2}	6 M KOH	-0.05-0.55 V (Hg/HgO)	61.5% (2 to 20 mA cm^{-2})	87.5% (5000)	[146]
L-CoNi-LDH@MXene	1420 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.5 V (Hg/HgO)	64.1% (1 to 20 A g^{-1})	94.2% (5000)	[147]
ZnNiCo-LDH	1908 F g^{-1} at 1 A g^{-1}	6 M KOH	0-0.75 V (Hg/HgO)	73.4% (1 to 10 A g^{-1})	76% (2000)	[148]
O_VIS-LDH	1111 C g^{-1} at 1 A g^{-1}	3 M KOH	0-0.6 V (Hg/HgO)		88.78% (10000)	[149]
$CoNi_3Mn_1$-OH/CC	955.7 C g^{-1} at 1 A g^{-1}	1 M KOH	0-0.6 V (Hg/HgO)	91.1% (1 to 10 A g^{-1})	85% (5000)	[150]
CoCu@NiCo-LDH	18.71 F cm^{-2} at 3 mA cm^{-2}	6 M KOH	-0.2-0.7 V (Hg/HgO)	87.3% (3 to 50 mA cm^{-2})	77.8% (5000)	[151]

Table S4. Summary of the electrochemical characteristics of the ZIF-67-derived phosphides materials in three-electrode measurements.

Electrode Materials	**Specific Capacity**	**Electrolyte**	**Potential Window (CV)**	**Capacity Retention**	**Cyclic stability**	**Ref.**
$Ni_xCo_{1-x}P$	548 C g^{-1} at 1 A g^{-1}	2 M KOH	0-0.6 V(SCE)	66.2% (1 to 40 A g^{-1})	86% (3000)	[152]
ZIF-67-LDH-CNP-110	1616 F g^{-1} at 1 A g^{-1}	6 M KOH	-0.15-0.35 V (Ag/AgCl)	80.32% (1 to 10 A g^{-1})	72.46% (2000)	[153]
CoP-CoNC/CC	975 F g^{-1} at 1 mA cm^{-2}	2 M KOH	0-0.6 V (Hg/HgO)	40% (1 to 10 mA cm^{-2})		[154]
N-CNTs@NiCoP/CoP	152 mAh g^{-1} at 1 A g^{-1}	2 M KOH	0-0.5 V (SCE)	61% (1 to 30 A g^{-1})	87% (5000)	[155]
NCP/NF	1.43 C cm^{-2} at 1 mA cm^{-2}	1 M KOH	-0.2-07 V (SCE)	6.8% (1 to 10 mA cm^{-2})	43.7% (5000)	[156]
CoP-NPC/GS	166 F g^{-1} at 3 A g^{-1}	2 M KOH	-0.1-0.4 V (Hg/HgO)	83% (3 to 15 A g^{-1})	88% (10000)	[157]
$NiCo_2O_4$@Co_2P/Ni_2P-CC	2881.88mF cm^{-2} at 2mA cm^{-2}	6 M KOH	0-0.6 V (Hg/HgO)	86.9% (2 to 20 mA cm^{-2})		[158]
Co(OH)F@CoP/CC	654 mC cm^{-2} at 1 mA cm^{-2}	3 M KOH	0-0.6 V	75.08% (1 to 10 mA cm^{-2})	71.34% (10000)	[159]
NiCoP@CC	1149.2 C g^{-1} at 1 A g^{-1}	3 M KOH	0-0.6 V (Hg/HgO)	88.6% (1 to 10 A g^{-1})	99.7% (10000)	[160]
CoP-NP@C	540 F g^{-1} at 1 A g^{-1}	2 M KOH	0-0.6 V (SCE)	73.1% (1 to 10 A g^{-1})	89% (10000)	[161]
Co_2P/Cu_3P	549 C g^{-1} at 1 A g^{-1}	6 M KOH	0-0.55 V (Hg/HgO)		84% (5000)	[162]
CoMoP-DSHNBs	1204 F g^{-1} at 1 A g^{-1}	3 M KOH	-0.1-0.55 V (Ag/AgCl)	39.86% (1 to 20 A g^{-1})	87% (20000)	[163]
ZCoPC	192.6 mAh g^{-1} at 1 A g^{-1}	1 M KOH	0-0.5 V (Ag/AgCl)		93.2% (5000)	[164]
V-CoP@MX/HCF	1896.8 F g^{-1} at 1 A g^{-1}	3 M KOH	-0.2-0.6 V (Ag/AgCl)	69.1% (1 to 10 A g^{-1})	91.1% (10000)	[165]

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