Electronic Supplementary Material (ESI) for Dalton Transactions.

Designing N-doped graphene-like supported highly dispersed bimetallic NiCoP NPs as an efficient electrocatalyst for water oxidation

Jiabo Wang[a, *], Yalin Fu[a], Peng Zhang[a], Jie Zhang[a], Xusen Ma[a, c], Jibo Zhang[a, *], Li Chen[b, *]

[a] Engineering Research Center of Jilin Provincial Higher Education University of Chemical Separation Technology, School of Petrochemical Technology, Jilin Institute of Chemical Technology, Jilin, 132022, P.R. China. E-mail: wangjb794@nenu.edu.cn

[b] Information Materials and Intelligent Sensing Laboratory of Anhui Province, Institutes of Physical Science and Information Technology, Anhui University, Hefei 230601, PR China. E-mail: lichen@ahu.edu.cn

[c] Wanhua Chemical Group Co., Ltd, Shandong, 264006, P.R. China

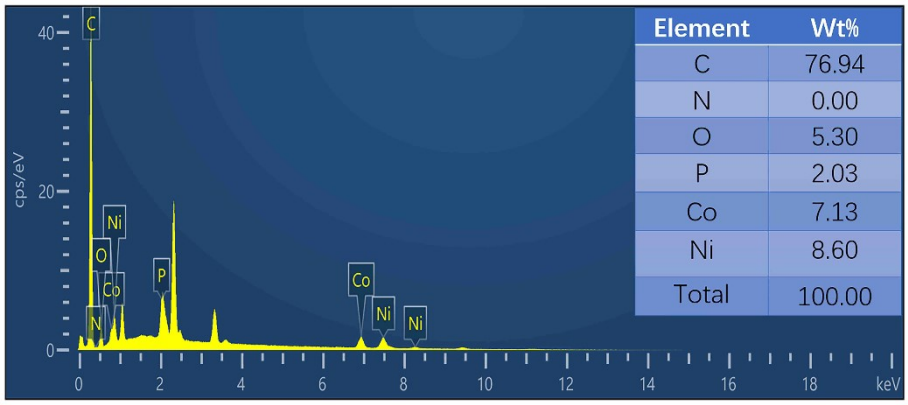

Figure S1 The EDS spectrum of NiCoP-3@GL.

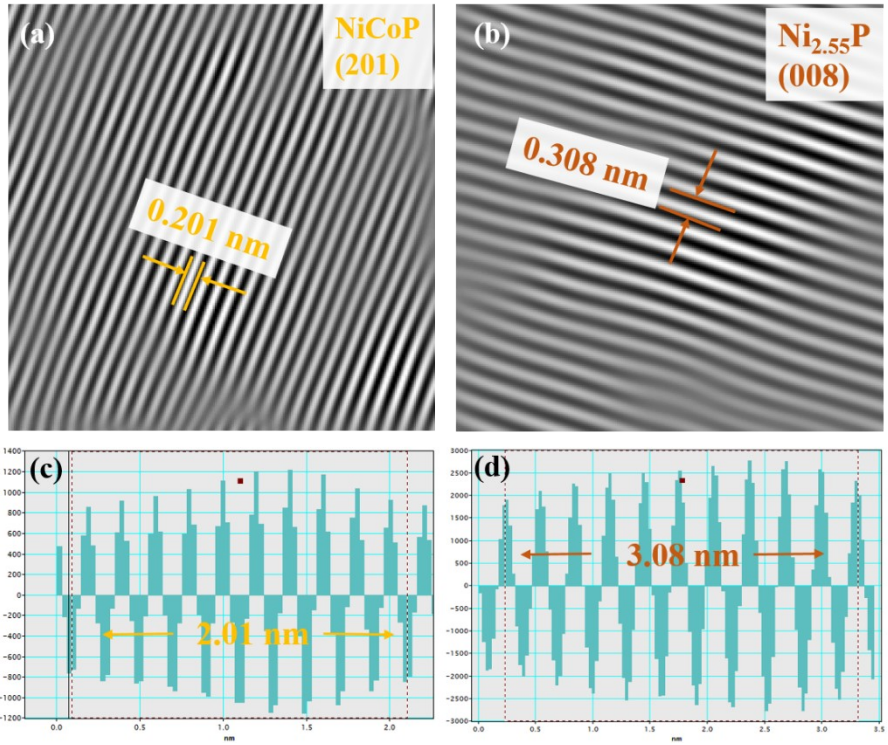

Figure S2 (a-d) FFT patterns and lattice spacings from the locations of (c) NiCoP and (d) $Ni_{2.55}P$ phases in Figure 3.

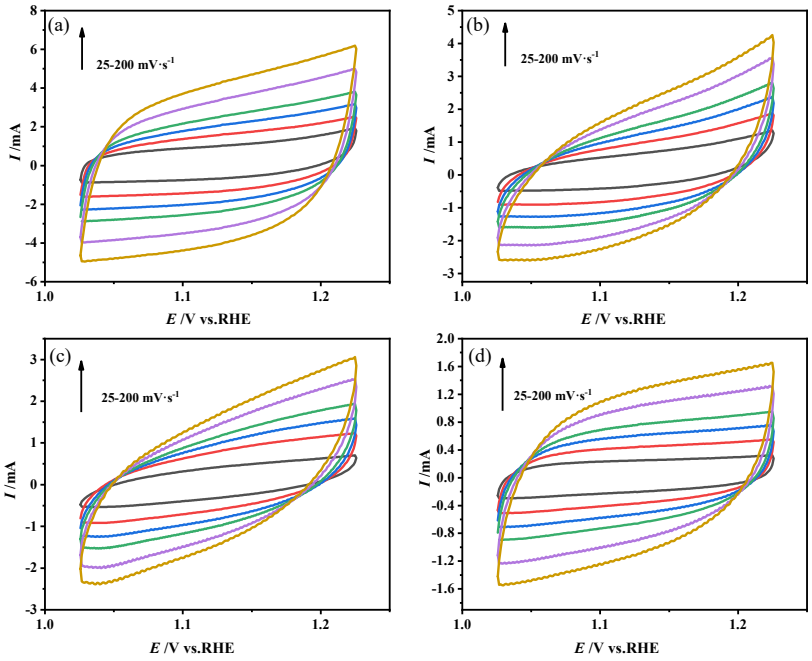

Figure S3 The CV curve of (a) NiCoP-3@GL, (b) NiP@GL, (c) CoP@GL, (d) CC.

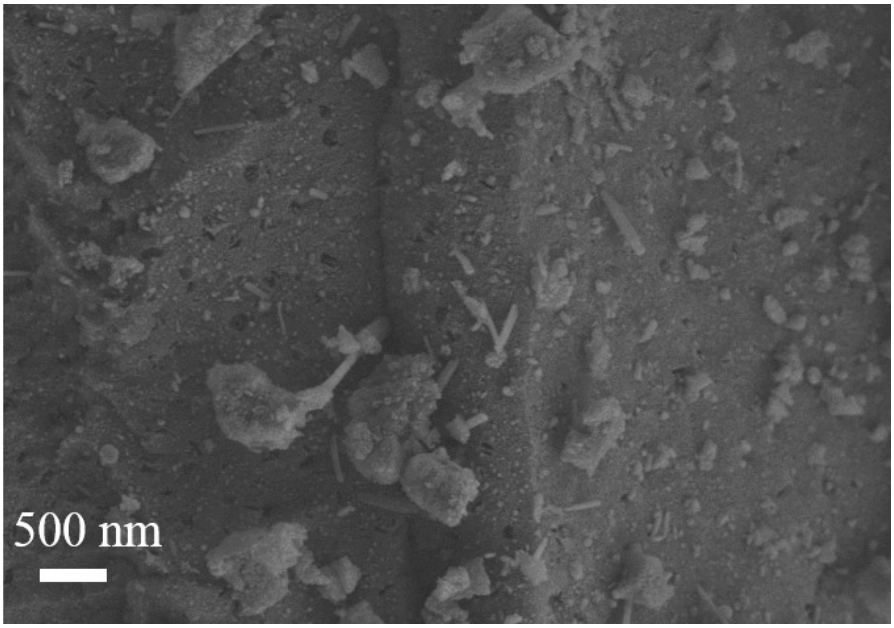

Figure S4 SEM image of NiCoP-3@GL sample after 5000 CV cycles.

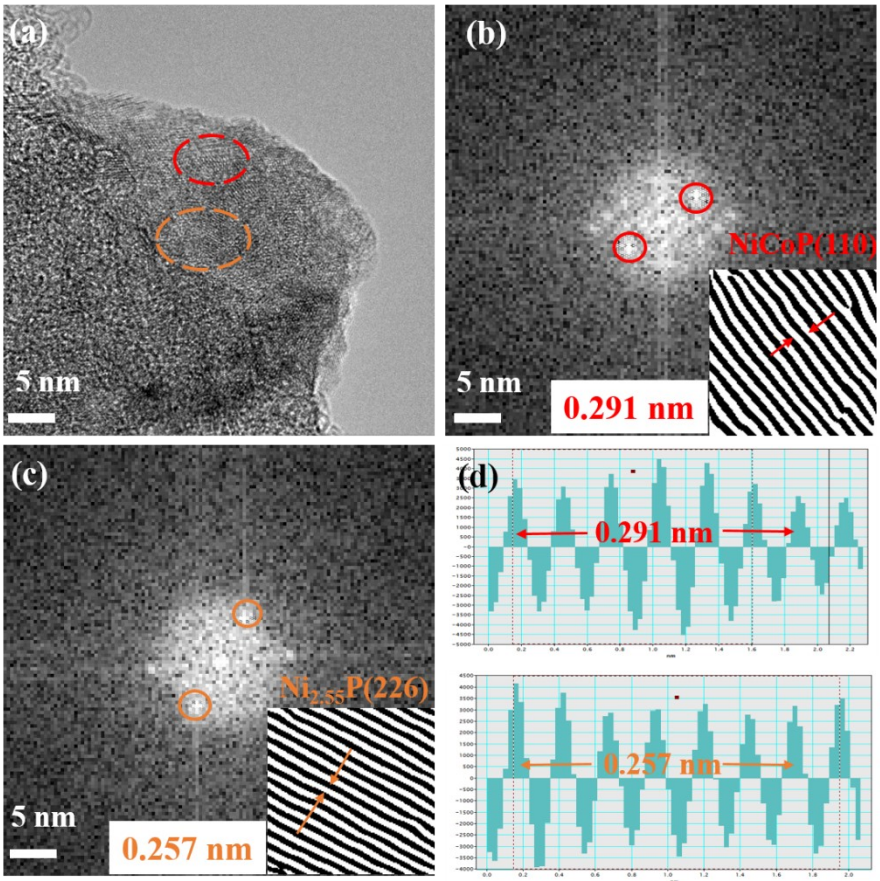

Figure S5 TEM image of NiCoP-3@GL sample after 5000 CV cycles.

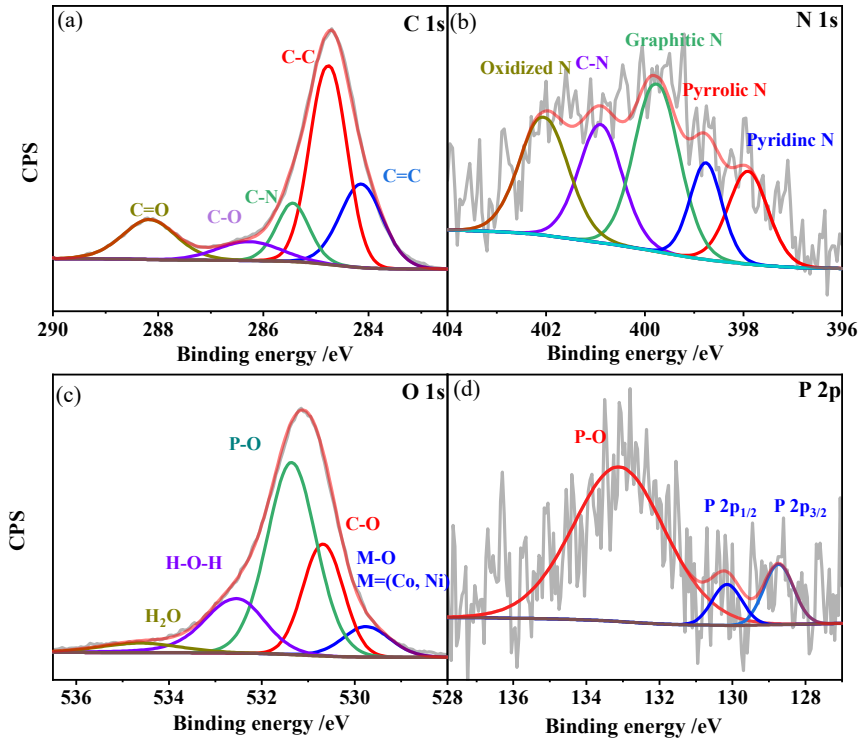

Figure S6 XPS of C 1s, N 1s, O 1s and P 2p of NiCoP-3@GL sample after 5000 CV cycles.

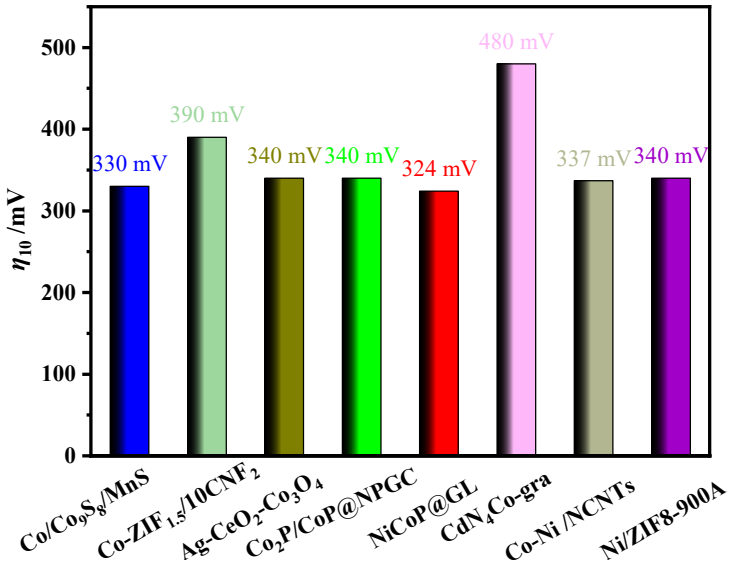

Figure S7 The comparison of catalytic performance of different cobalt-based and nickel-based electrocatalysts.

Table S1. NiCoP-*x* @GL, CoP@GL, NiP@GL, CC and RuO_2 overpotential and Tafel.

Samples	η_{10} (mV vs. RHE)	b (mV·dec^{-1})
NiCoP-2@GL	355	68.66
NiCoP-3@GL	324	97.28
NiCoP-4@GL	353	157.59
CoP@GL	507	75.01
NiP@GL	473	76.67
CC	525	180.10
RuO_2	292	52.19

Table S2 Results of C_{dl}, j_{ECSA} and j_{mass} of NiCoP-3@GL, CoP@GL, NiP@GL and CC in 1.0 M KOH solution.

Samples	C_{dl} (mF cm^{-2})	$ECSA$ (cm^2)	$\eta@j_{ECSA=0.002}$ (mV vs. RHE)	$\eta@\ j_{mass=2}$ (mV vs. RHE)
NiCoP-3@GL	18.19	452.75	340	370
CoP@GL	6.70	167.50	459	590
NiP@GL	8.23	205.75	444	528
CC	5.63	140.75	444	

Table S3 The electrochemical impedance fitting parameters for NiCoP-3@GL recorded in 1.0 M KOH solution.

R_s (Ω)	8.006
Q_1-Y_1 (μS · s^{n1})	9.312*10^{-4}
n_1 (0<n_1<1)	8.616*10^{-1}
R_1 (Ω)	1.00*10^{-2}
W(Ω·cm^2)$_{n1}$	3.059*10^{-12}
Q_2-Y_2 (μS · s^{n1})	2.152*10^{-3}
n_2 (0<n_2<1)	3.994*10^{-1}
R_2 (Ω)	3.139*10^3

Table S4. Overview of OER performance of recently reported Co-based Ni-based catalysts.

Samples	η_{10} (mV vs. RHE)
$Co/Co_9S_8/MnS$	330
$Co\text{-}ZIF_{1.5}/10CNF_2$	390
$Ag\text{-}CeO_2\text{-}Co_3O_4$	340
$Co_2P/CoP@NPGC$	340
NiCoP-3@GL	324
$CdN_4Co\text{-}gra$	480
Co-Ni/NCNTs	337
Ni/ZIF8-900A	340