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Supplementary Information

Hierarchically Porous, Biaxially Woven Carbon Nanotube Sheet Arrays for Next-Generation Anion-Exchange Membrane Water Electrolyzers

Ji Eun Park[a], Yung-Eun Sung[b,c*], Changsoon Choi[a*]

[a]Department of Energy and Materials Engineering, Dongguk University, Seoul 04620, Republic of Korea

[b]Center for Nanoparticle Research, Institute for Basic Science (IBS), Seoul 08826, Republic of Korea

[c]School of Chemical and Biological Engineering, Seoul National University, Seoul 08826, Republic of Korea

Corresponding Authors
*E-mail: ysung@snu.ac.kr (Y.-E. Sung) and cschoi84@dongguk.edu (C. Choi),

Table S1. Comparison of ohmic, charge-transfer, and mass transport resistances of four AEMWEs obtained using the Nyquist plot.

Sample name	Ohmic resistance	Charge-transfer resistance	Mass transport resistance
$NiFeO_x$_CNTS	65	177	0.112
$NiFeO_x$_NP	126	495	0.228
Pt_CNTS	75	12.0	0.06
Pt_NP	99	12.5	0.2

Table S2. Comparison of AEMWE performances using the non-noble metal-based HER catalysts reported in the literature[44-54] and in this work.

Reference number	Cathode material	Cathode loading [mg cm^{-2}]	Membrane	Anode material	Anode loading [mg cm^{-2}]	Temperature [°C]	Cell voltage [V]	Current density [A cm^{-2}]
This work	**$NiFeO_x$**	**2**	**FAA-3-50**	**NiFe**	**1**	**70**	**2.05**	**1480**
44	$Ni_{12}P_5Ni_3(PO_4)_2$	3	YAB	$Ni_{12}P_5Ni_3(PO_4)_2$	3	50	2.05	650
46	Ni	0.18	FAA-3-50	CuCoO	0.4	40	2.05	75
47	Ni	1.45	FAA-3-50	Ni	1.45	40	2.05	60
45	NiCoS	-	Nafion	IrO2	-	50	2.05	610
48	NiCoO-NiCo/C	1.5	X37-50	CuCoO	30	50	1.85	504
49	NiCu	5	Fumapem-3-pe-30	Ir	3	50	1.9	1350
50	Ni	0.38	FAA-3-50	CuCoO	0.4	-	2.05	110
51	NiFeCo-P	-	X37-50	NiFeO	-	50	1.72	500
52	NiMnO	1	Fumapem-3-pe-30	NiCoFe	3	50	2.0	1150
53	$Ni/(CeO_2-La_2O_3)/C$	2.7	A201	ACTA 3030	-	-	1.9	300
54	$Ni/(CeO_2-La_2O_3)/C$	7.4	A201	ACTA 3030	30	60	1.9	350

Table S3. Comparison of AEMWE performances using the noble metal-based HER catalysts

Reference number	Cathode material	Cathode loading [mg cm^{-2}]	Membrane	Anode material	Anode loading [mg cm^{-2}]	Temperature [°C]	Cell voltage [V]	Current density [A cm^{-2}]
This work	**Pt**	**2**	**FAA-3-50**	**NiFe**	**1**	**70**	**2.05**	**4000**
55	PtNi/CP	0.001856	A201	Ni/CP	0.00851	50	1.9	250
57	$RuSe_2$	2	FAA-3-50	IrO_2	2.5	80	1.8	730
56	TNTA+Pd	1.7	A201	IrO_2	5	60	2.05	1000
58	Pt/C	-	A201	IrO_2	-	50	1.8	1030
59	Pt/C	0.4	FAA-3-50	IrO_2	2	70	2.05	2400
60	Pt/C	1	FAA-3-50	IrO_2	0.5	80	1.73	1000
61	Pt/C	1		CuCoO		40	1.9	2250
62	Pt/C	1		CuCoO	0.2	45	1.9	1900
63	Pt/C	1	X37-50	COO-NP	3	50	2.0	1150
7	Pt/C	1	X37-50	NiFeOx		-	1.9	2000
64	Pt/C	-	X37-50	NiFeV	3.95	50	1.9	2850

reported in the literature[7,55-64]and in this work.

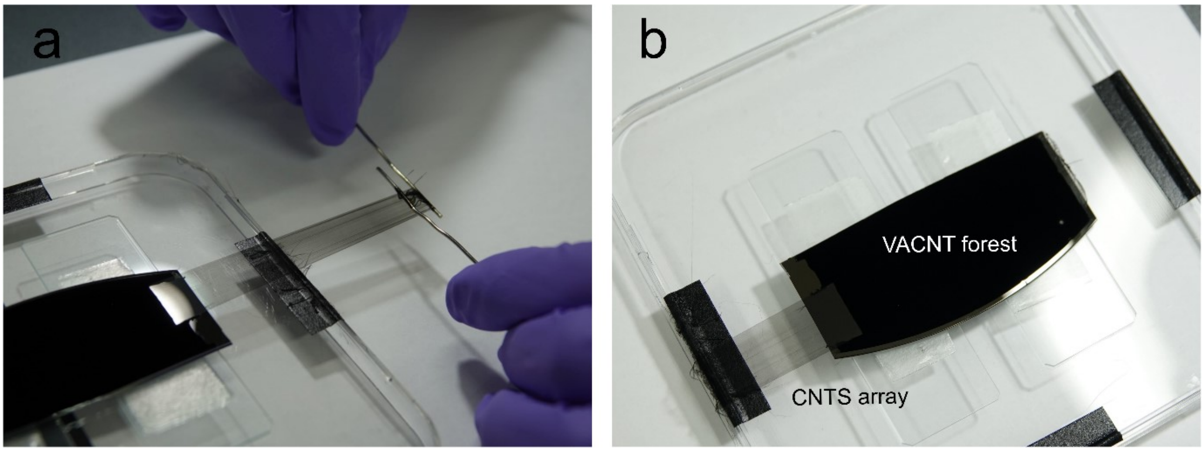

Figure S1. Photograph of process: (a) drawing carbon nanotube sheet (CNTS) from the vertically aligned carbon nanotube (VACNT) forest and (b) resulting single CNTS array.

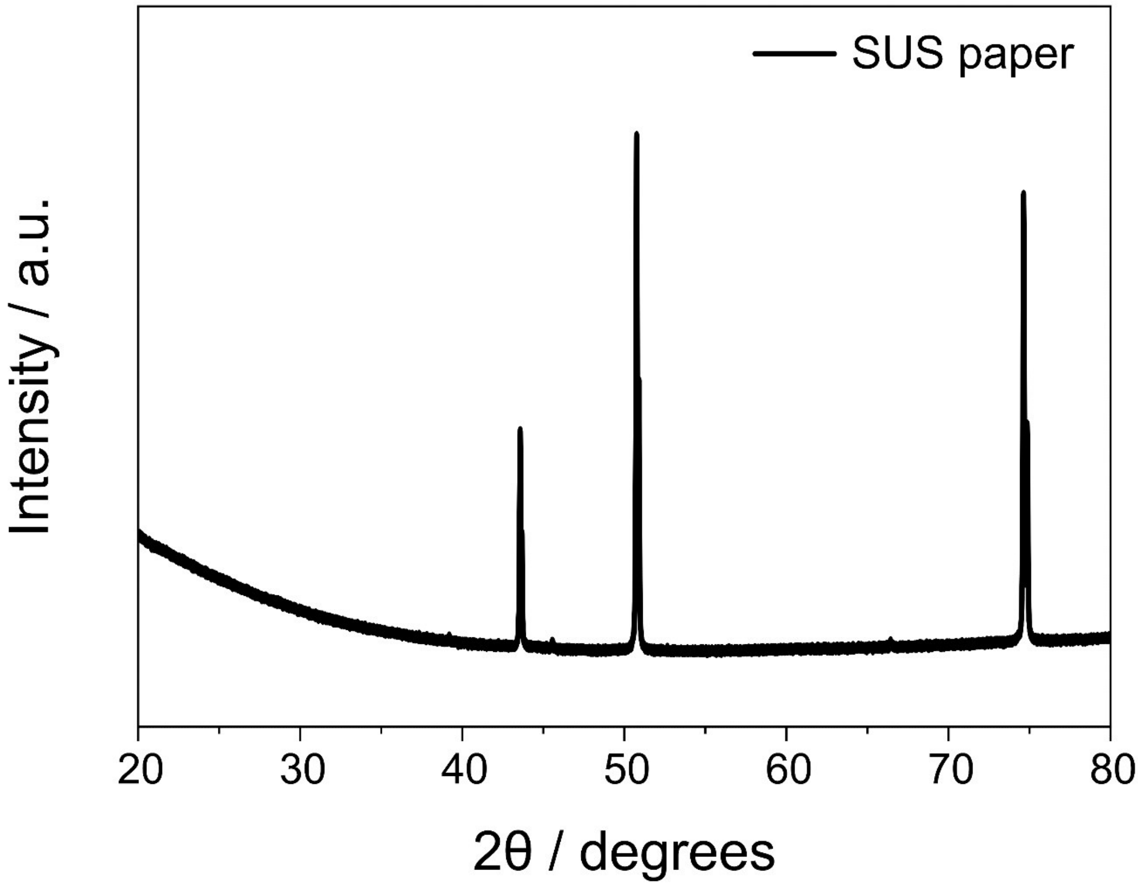

Figure S2. X-ray diffraction (XRD) patterns of SUS paper.

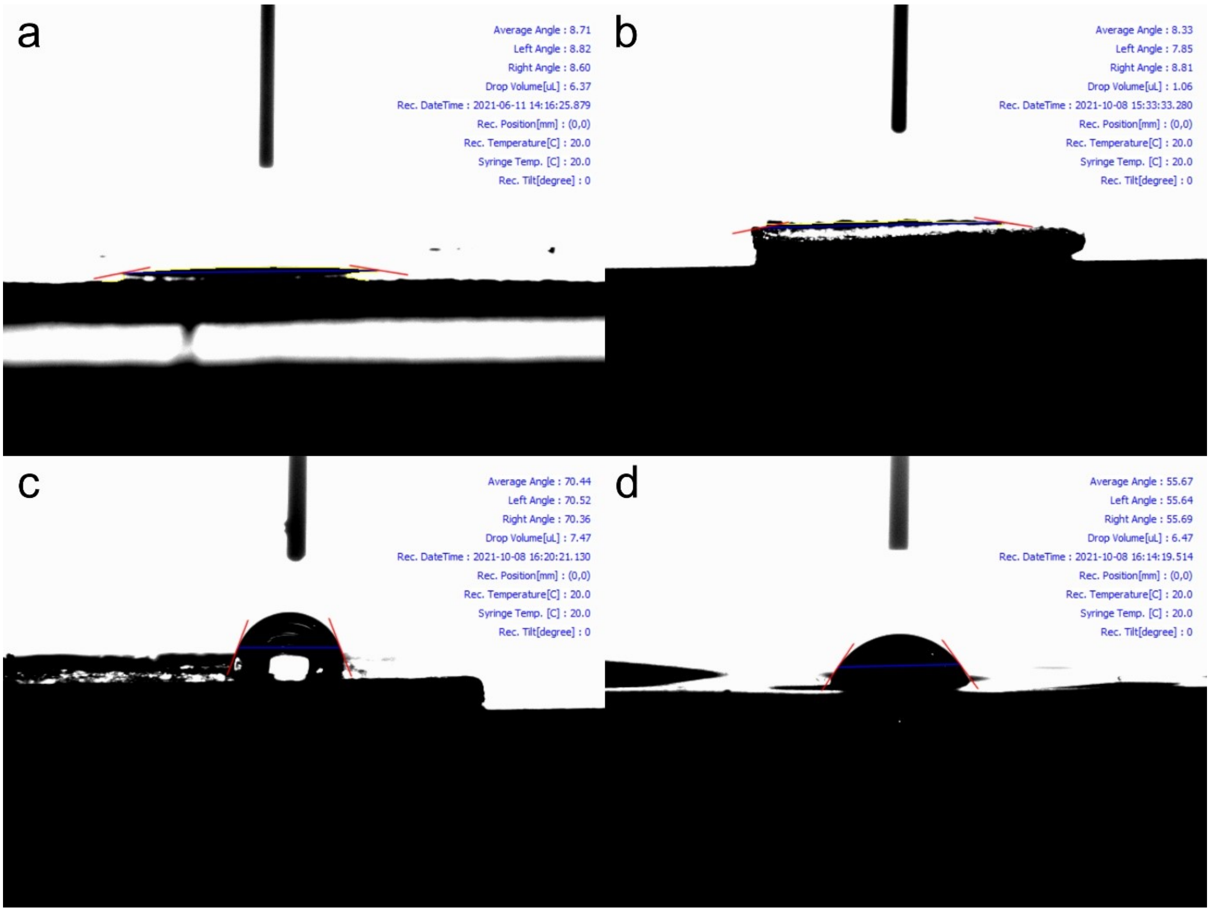

Figure S3. Contact angles of four electrodes: (a) $NiFeO_x$_CNTS, (b) $NiFeO_x$_NP, (c) Pt_CNTS, and (d) Pt_NP.

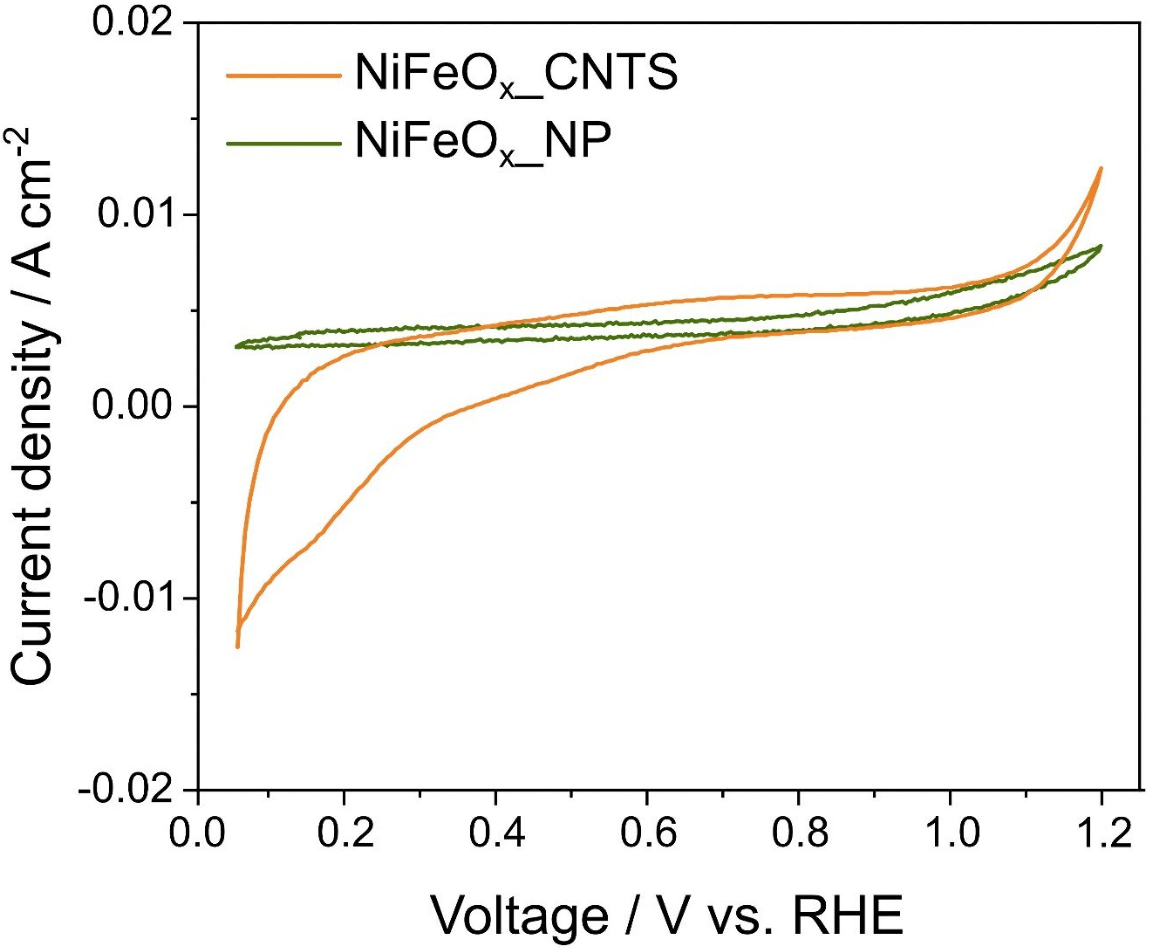

Figure S4. Cyclic voltammograms of $NiFeO_x$_CNTS and $NiFeO_x$_NP.

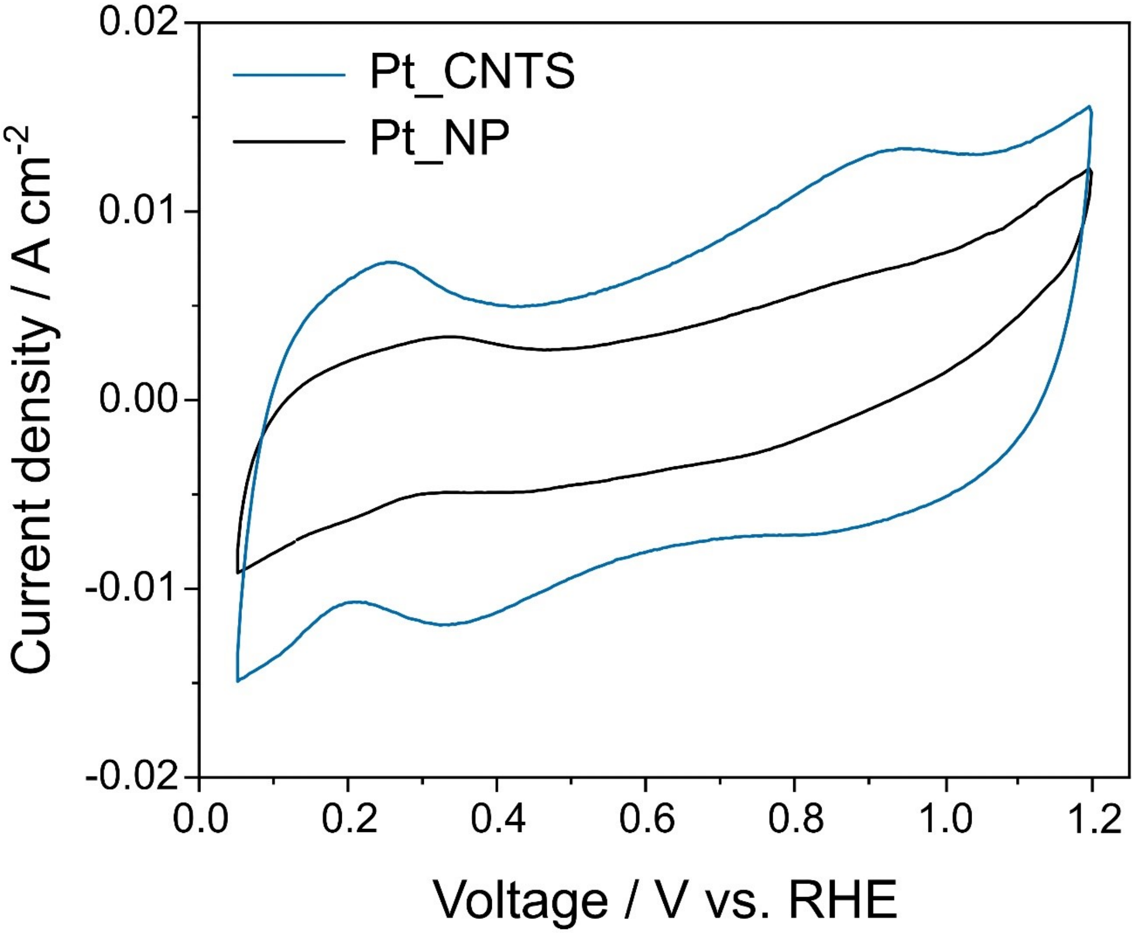

Figure S5. Cyclic voltammograms of Pt_CNTSs and Pt_NPs.

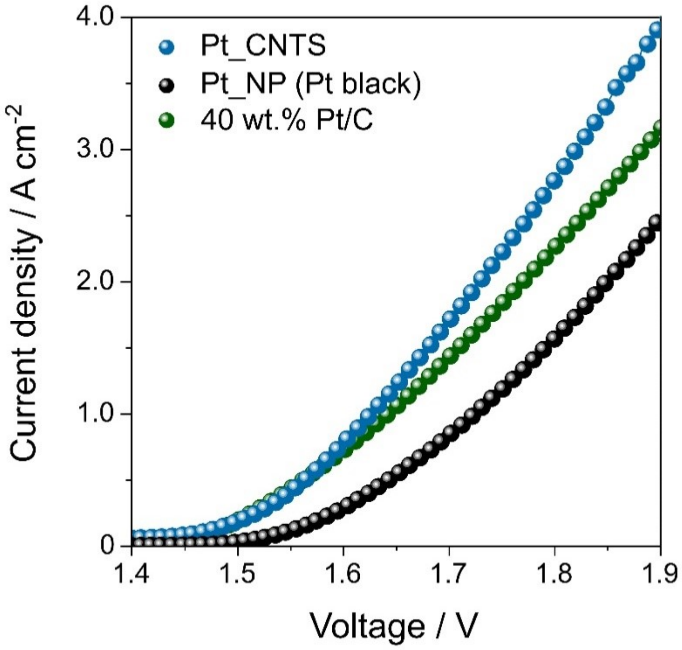

Figure S6. Polarization curves for AEMWE using Pt_CNTS, Pt_NP (Pt black), and 40 wt.% Pt/C.

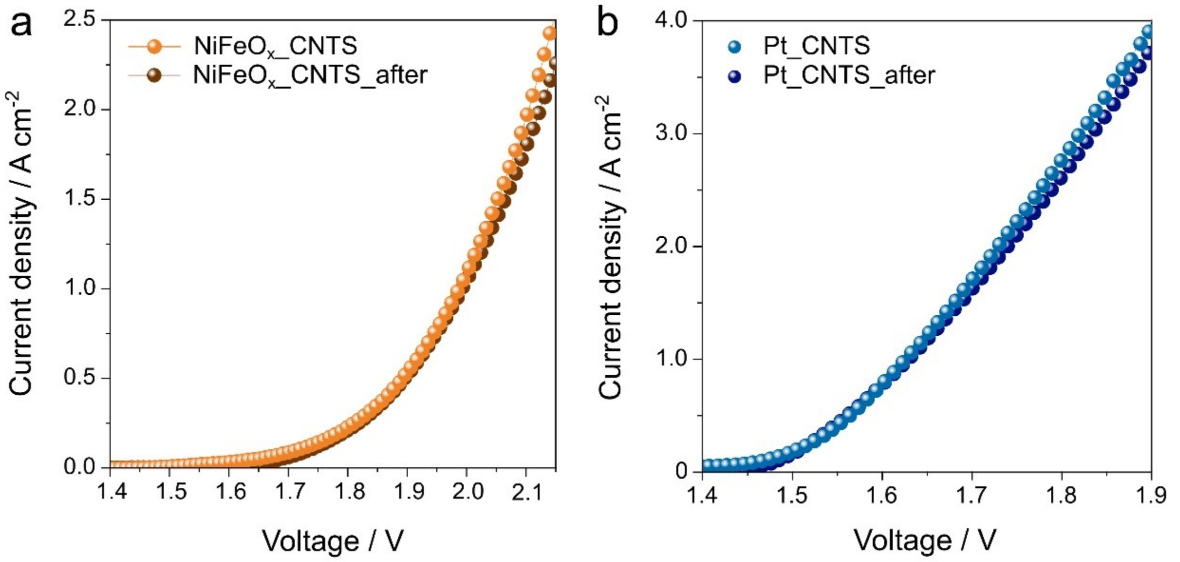

Figure S7. Comparison of polarization curves of two AEMWEs ((a) $NiFeO_x$_CNTS and (b) Pt_CNTS) before and after the durability test.