Supplementary Information (SI) for Industrial Chemistry & Materials.

Unlocking the potential of chemical-assisted water electrolysis for green hydrogen production

Jiwoo Lee,[a] Sol A Lee,[a,b] Tae Hyung Lee,[c] and Ho Won Jang*[a,d]

[a]Department of Materials Science and Engineering, Research Institute of Advanced Materials, Seoul National University, Seoul 08826, Republic of Korea

[b]Department of Applied Physics and Materials Science, California Institute of Technology, Pasadena 91126, United States

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

[d]Advanced Institute of Convergence Technology, Seoul National University, Suwon 16229, Republic of Korea

E-mail: hwjang@snu.ac.kr

*Corresponding author: hwjang@snu.ac.kr (H.W. Jang)

Table 1. Comparison of the stability of MOR electrocatalysts in various operating potentials.

Catalysts	Applied potential	Stability (s)	Electrolyte	Ref.
Pt–Ni/CNSs (2 : 1)	0.31 V vs Ag/AgCl	3,600	0.5 M H_2SO_4 + 1 M CH_3OH	1
PtAg/graphene	0.35 V vs Ag/AgCl	2,000	0.1 M $HClO_4$ + 1.0 M CH_3OH	2
Pt/Nb-Mo_2C-rGOh	0.29 V vs Ag/AgCl	3,600	0.5 M H_2SO_4 + 1.0 M CH_3OH	3
Pt/Mo_2C-rGO	0.34 V vs Ag/AgCl	3,600	0.5 M H_2SO_4 + 1.0 M CH_3OH	3
PtBi	0.35 V vs Ag/AgCl	1,200	1.0 M H_2SO_4 + 1.0 M CH_3OH	4
PtNi/PANI	-0.53 V vs Ag/AgCl	3,600	0.5 M KOH + 1.0 M CH_3OH	5
nano-NiPh/Pt	-0.32 V vs Ag/AgCl	1,500	0.25 M KOH + 0.25 M CH_3OH	6
PtNi/SiO_2/PANI/CPE	-0.54 V vs Ag/AgCl	2,000	0.5 M KOH + 1 M CH_3OH	7
p-Pt/NiCu/p-MDAB/MWCNT	0.40 V vs. RHE	4,000	0.1 M NaOH + 0.5 M CH_3OH	8
RGO/PANI/Pt/Cu	-0.54 V vs Ag/AgCl	400	0.5 M KOH + 1 M CH_3OH	7
PtCo(1:9)/rGO	0.378 V vs Ag/AgCl	1,000	1 M H_2SO_4 + 2.0 M CH_3OH	9
Pd/CeO_2	-0.192 V vs Ag/AgCl	10,800	1 M KOH + 0.5 M CH_3OH	10
Pd–Mn_3O_4/C	-0.58 V vs Hg/HgO	28,800	1 M KOH + 1 M CH_3OH	11
Pt/karst-Ni	-0.49 V vs. SCE	3,600	1 M KOH+1 M CH_3OH	12
Pt/CoSe-0.2/NiSe-nrsa/NF	-0.449 V vs. SCE	3,600	1 M KOH + 1 M CH_3OH	13
$PtCu_2$/rGO	0.27 V vs. SCE	7,200	0.5 M H_2SO_4 + 1 M CH_3OH	14
Mo@Pd/MWCNT	-0.55 V vs. SCE	1,000	1 M KOH + 1 M CH_3OH	15
$Ni_{0.6}Zn_{0.4}O$/GCE	0.445 V vs Ag/AgCl	36,000	1 M KOH + 0.1 M CH_3OH	16
Ni@3DHPG	0.32 V vs Ag/AgCl	3,600	1 M KOH + 0.75 M CH_3OH	17
NiO_AC@PPy/GCE	0.5 V vs Ag/AgCl	10,000	1 M KOH + 0.5 M CH_3OH	18
$Ni_{97}Bi_3$	0.31 V vs Ag/AgCl	43,200	1 M KOH + 1 M CH_3OH	19
Fe-NF-500	1.328 V vs. RHE	144,000	1 M KOH + 1 M CH_3OH	20
Ni-Cu/TiN	0.4 V vs Ag/AgCl	3,600	1 M KOH + 1 M CH_3OH	21
$NiCo_2O_4$ /S-rGO	0.12 V vs. Hg/HgO	36,000	1 M KOH + 0.5 M CH_3OH	22

Table 2. Comparison of the N_2 Faradaic efficiency of AOR electrocatalysts

Catalysts	N_2 Faradaic Effciency	Applied potential	Electrolyte	Ref.
$CuSn(OH)_6$ nanorods	84.5	1.0 V vs. Hg/HgO	0.5 M K_2SO_4 + 10 mM NH_3	23
$Ni(OH)_2$/NiOOH	76.6	1.0 V vs. Hg/HgO		24
$Ni_{0.8}Cu_{0.2}$ oxyhydroxide	2	1.53 V vs. RHE	0.1 M KOH + 0.5 mM $(NH_4)_2SO_4$	25
tst-$Ni(OH)_2$	66	0.6 V vs. Hg/HgO	1.5 M NaOH + 0.5 M NH_3	26
ust-$Ni(OH)_2$	30.5	0.6 V vs. Hg/HgO	1.5 M NaOH + 0.5 M NH_3	26
NiCu/MnO2	97.4	0.6 V vs/ Hg/HgO	0.5 M NaOH + 55 mM NH_4Cl	27
NiCu	53.8	0.6 V vs/ Hg/HgO	0.5 M NaOH + 55 mM NH_4Cl	27
$NiCu_3$-N-C DAC catalyst	97.8	1.5 V vs. RHE		28
500 CV-Pt	90	-0.25 V vs. Ag/AgCl	5 M KOH + 1 M NH_3	29
electrodeposited Pt	80	0.5 V vs. RHE	0.5 M KOH + 0.1 M NH_3	30
Pt–Ir–Rh	91.8	Max. 1 V	0.2 M KOH + 21.5mM NH_4OH	31

Table 3. Comparison of the applied voltages of UOR electrocatalysts in various operating current density.

Anode Catalysts	**Current density (mA cm^{-2})**				**Electrolytes (1 M KOH + xM Urea)**	**Ref.**
	10	20	50	100	Urea (M)	
Ni-WO_3				1.4	0.33	32
NiFe oxalate (O-NFF)				1.409	0.33	33
Ni-S-Se/NF	1.47			1.6	0.5	34
Rh_{SA}-S-Co_3O_4	1.33				0.5	35
CoS_2/MoS_2	1.29				0.5	36
Fe-$Co_{0.85}Se$/FeCo LDH	1.32			1.52	0.5	37
Co(OH)F/NF		1.42			0.7	38
$Ni(OH)_2$/CuO NWs/CF		1.38			0.5	39
Fc-NiCo-BDC				1.47	0.5	40
NCVS-3	1.305				0.33	41
Rh-Co_3S_4/CoO_x NTs	1.35		1.48		0.5	42
Ni SAs-NC	1.39				0.33	43
O-NiMoP/NF	1.36		1.55		0.5	44
$Ni_2Fe(CN)_6$				1.35	0.33	45
CoP@PNC/PCWF			1.5		0.5	46

Table 4. Comparison of the applied voltages of HzOR electrocatalysts in various operating current density.

Catalysts	**Current density (mA cm^{-2})**							**Electrolytes (1 M KOH +xM N_2H_4)**	**Ref.**
	10	50	100	200	300	400	500	N_2H_4 (M)	
Ni_3N-Co_3N PNAs/NF	0.071					0.76		0.1	47
Fe-CoS_2							0.95	0.1	48
Ni-Co-P/NF				0.88				0.1	49
$CoSe_2$	0.164							0.5	50
Ni-C HNSA		0.14		0.4				0.1	51
HEANC/C	0.025		0.181					0.1	52
$CoPt_3$/CoPt⊂P_LNC	0.13	0.27	0.49					0.5	53
PW-Co_3N NWA/NF	0.028			0.277				0.1	54
Mo-Ni_3N/Ni/NF	0.055	0.187	0.265		0.423			0.1	55
D-MoP/rGO			0.74					0.5	56
Cu_1Co_2-Ni_2P/NF	0.16		0.39					0.1	57
CC@WO_3/Ru SAs	0.025							0.5	58
CC@WS_2/Ru SAs	0.0154							0.5	59
RP-CPM	0.023							0.3	60
Ru/PNC			0.19					0.5	61

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