Electronic Supplementary Information

Table S1. Comparison of MOR activity of some recently reported Au-based electrocatalysts.

Catalysts	Electrolyte	Specific activity ($mA\ cm^{-2}$)	Mass activity ($A\ mg^{-1}$)	Ref.
Core-shell Au-Pt nanodendrites	0.5 M H_2SO_4 + 1 M CH_3OH	1.28	0.45	1
Au_2Pt_1/C	0.1 M $HClO_4$ + 1 M CH_3OH	--	0.75	2
Au_1Pt_1/C			0.71	
Au_1Pt_2/C			0.58	
AuPt nanotubes	0.5 M H_2SO_4 + 0.5 M CH_3OH	0.9	1.84	3
Au_4Pt_5 nanotubes		0.84	1.66	
Au_3Pt_5 nanotubes		0.82	1.57	
AuPt bipyramid nanoframes	0.5 M KOH + 0.5 M CH_3OH	--	0.99	4
dandelion-like Au@Pd/rGO	0.5 M KOH + 1 M CH_3OH	2.16	0.87	5
PdAu-P ternary alloy	0.1 M KOH + 0.5 M CH_3OH	1.06	0.49	6
Au@Ni-rGO nanocomposites	0.5 M KOH + 0.5 M CH_3OH	--	1.447	7
Au@Ni@PtNiAu sandwich nanocrystals	0.5 M H_2SO_4 +1 M CH_3OH	2.05	0.346	8
hollow AuAg nanourchins	0.5 M KOH+2 M CH_3OH	--	0.0139	9

Table S2. Comparison of various Au-based catalysts towards EOR.

Catalysts	Electrolyte	Specific activity ($mA\ cm^{-2}$)	Mass activity ($A\ mg^{-1}$)	Ref.
Au@Pt star-like nanocrystals	0.5 M KOH + 0.5 M C_2H_5OH	13.34	7.03	10
Au@Pt triangular nanoprisms		~7.58	~2.78	
Zigzag PtAu alloy surface on Au nanopentagrams	1 M KOH + 1 M C_2H_5OH	8.3	4.4	11
Porous PtAu alloyed nanoflowers	1 M KOH + 0.5 M C_2H_5OH	7.06	0.951	12
$Pt_{10}Au_{10}Cu_{80}$/C	0.5 M H_2SO_4 + 0.5 M C_2H_5OH	--	0.452	13
$Pt_{20}Au_{20}Cu_{60}$/C			0.346	
$Pt_{30}Au_{30}Cu_{40}$/C			0.193	
Nanoporous Au	1 M KOH + 1 M C_2H_5OH	--	0.308	14
Poly-Au electrode			0.022	
Au-P/C	0.5 M KOH + 1 M C_2H_5OH	3.53	0.642	15
Au/C		1.34	0.082	
Au@Pd core-shell nanorods	1 M KOH + 1 M C_2H_5OH	--	2.92	16
Hexoctahedral-shaped Au@AuPd NPs	0.5 M KOH + 0.5 M C_2H_5OH	9.5	11.9	17
Elongated tetrahexahedral-shaped Au@AuPd NPs		9.0	9.7	
Octahedral-shaped Au@AuPd NPs		6.8	7.1	
Au@PdNi core-shell NPs	1 M KOH + 1 M C_2H_5OH	11.8	5.891	18
Au@PdAgNSs/rGO	1 M KOH + 1 M C_2H_5OH	6.39	--	19
Au@PdAgNSs		2.43		

Table S3. Comparison of FAOR activity of some recently reported Au-based electrocatalysts.

Catalysts	Electrolyte	Specific activity ($mA\ cm^{-2}$)	Mass activity ($A\ mg^{-1}$)	Ref.
Nanoporous $Au_{99.5}Pt_{0.5}$	0.5 M H_2SO_4 + 0.5 M HCOOH	10.22	7.01	20
Nanoporous $Au_{99}Pt_1$		7.82	5.92	
Nanoporous $Au_{98}Pt_2$		6.09	4.51	
Nanoporous $Au_{95}Pt_5$		2.57	4.95	
PtAu/N- graphene	0.5 M H_2SO_4 + 0.5 M HCOOH	14.95	1.847	21
PtAu alloy nanotubes	0.5 M H_2SO_4 + 0.5 M HCOOH	--	1.445	22
Dendritic core-shell $Au_{79}@Pd_{21}$	0.5 M H_2SO_4 + 0.5 M HCOOH	1.897	0.835	23
Dendritic core-shell $Au_{71}@Pd_{29}$		2.167	1.405	
Dendritic core-shell $Au_{56}@Pd_{44}$		2.333	1.160	
Flower-like Au@AuPd NPs	0.5 M H_2SO_4 + 0.5 M HCOOH	1.99	1.25	24
Sandwich-structured Au@polyallylamine@Pd	0.5 M H_2SO_4 + 0.5 M HCOOH	10.7	--	25
$Ru@Au_5Pt_5$ core-shell NPs	0.5 M $HClO_4$ + 0.5 M HCOOH	4.14	1.2	26
Surface copper removed CuAuPd/C	0.5 M H_2SO_4 + 0.5 M HCOOH	--	1.07	27
$Au_6Pt_1Rh_{0.5}$ nanowires/C	0.5 M H_2SO_4 + 0.5 M HCOOH	14.3	8.05	28

Table S4. Comparison of ORR performance of various Au-based electrocatalysts.

Catalysts	Electrolyte	$E_{1/2}$ (V vs. RHE)	Specific activity at 0.9 V (mA cm^{-2})	Mass activity at 0.9 V (A mg^{-1})	Ref.
Pt monolayer on nanoporous Au	0.1 M $HClO_4$	--	0.89	1.57	29
Pt_1Au_1 nanowires	0.1 M $HClO_4$	0.705	0.013	0.008	30
$Pt_1Au_1/(TiO_2)_{0.5}$ nanowires		0.889	0.448	0.304	
$Pt_1Au_1/(TiO_2)_1$ nanowires		0.889	0.441	0.381	
$Pt_1Au_1/(TiO_2)_2$ nanowires		0.740	0.071	0.037	
Au−PtFe/C annealed at high temperature	0.1 M $HClO_4$	0.926	--	0.66	31
AuPt flower like-assembly nanochains	0.1 M KOH	0.87	0.43	0.155	32
AuPd flower like-assembly nanochains		--	0.48	0.142	
PdAu NPs on graphene oxide	0.1 M KOH	0.9	1.577	0.526	33
Au nanowires @Pd-polyethylenimine nanohybrids	0.1 M KOH	0.9	--	0.295	34
Dealloyed AuNi nanodendrites	0.1 M KOH	0.911	0.11	0.09 (at 0.85 V)	35
AuCu aerogels	0.1 M KOH	0.868	0.906 (at 0.85 V)	0.96 (at 0.85 V)	36
Self-supported AuCuCo NPs	0.1 M KOH	0.824	--	0.443 (at 0.8 V)	37

Table S5. Comparison of various Au-based electrocatalysts for HER.

Catalysts	Electrolyte	Overpotential at 10 $mAcm^{-2}$ (mV)	Tafel slope ($mV\ dec^{-1}$)	Ref.
AuPt alloy nanodendrites / reduced graphene oxide	0.5 M H_2SO_4	48	34	38
Cathodically activated Au/TiO2 nanocomposite	0.5 M H_2SO_4	38	35	39
Au aerogel / graphitic carbon nitride	0.5 M H_2SO_4	185	53	40
Au NPs@citrate	0.5 M H_2SO_4	270	74	41
Flower-like Au@AuPd nanocrystals	0.5 M H_2SO_4	55	34	24
$Au_{75}Rh_{25}$ core-shell star-shaped decahedra	0.5 M H_2SO_4	64.1	33.8	42
$Au_{68}Rh_{32}$ core-shell star-shaped decahedra		77.4	38.9	
AuCu NPs/carbon nanofibers	0.5 M H_2SO_4	83	70	43
MoS_2–Au nanohybrids	0.5 M H_2SO_4	66	40	44
AuNi heterodimers	1 M KOH	97	67.5	45

Table S6. Comparison of OER activity of some recently reported Au-based electrocatalysts.

Catalysts	Electrolyte	Overpotential at 10 $mAcm^{-2}$ (mV)	Tafel slope ($mV\ dec^{-1}$)	Ref.
Au/Ir nanochains	1 M KOH	300	52.94	46
Au@$CoFeO_x$ core-shell NPs	1 M KOH	328 ± 3	58	47
Self-supported AuCuCo NPs	0.1 M KOH	596	160	37
Au–Fe nanoalloys	1 M KOH	800	163	48
Carbon supported AuIr	0.1 M NaOH	~394	--	49
$NiCeO_x$-Au catalyst	1 M NaOH	271	--	50
AuNi heterodimers	1 M KOH	350	45.9	45
Au/$NiCo_2O_4$ nanoarrays	1 M KOH	360	63	51
Au-$Ni_{12}P_5$ core/shell NPs	1 M KOH	340	49	52
Nanoporous Au/$CoMoN_x$	1 M KOH	230	46	53
Nanoporous Au/$CoMoO_4$		270	65	
Nanoporous Au/CoN_x		310	68	

Table S7. Comparison of various Au-based electrocatalysts for CO_2 reduction to CO.

Catalysts	Electrolyte	Potential (V vs. RHE)	CO Faradaic efficiency	CO partial current density (mA cm^{-2})	Ref.
Nano-folded Au catalysts	0.1 M $KHCO_3$	−0.5	87.4%	2.4	54
Nanoporous Au	0.1 M $NaHCO_3$	−0.6	95.9%	--	55
Nanoporous Au leaf	0.5 M $KHCO_3$	−0.57	90%	1.8	56
Au NPs embedded in graphene nanoribbon	0.5 M $KHCO_3$	−0.66	92%	--	57
Au NPs/ reduced graphene oxide Oleylamine modified Au NPs/ reduced graphene oxide	0.1 M $KHCO_3$	−0.7	52% 75%	--	58
Au-Fe core-shell NPs	0.5 M $KHCO_3$	−0.4	97.6%	11.05	59
Core-shell nanoporous $AuCu_3$@Au	0.1 M $KHCO_3$	−0.6	97.27%	5.3	60
Annealed Au-urea/C Annealed Au-sodium sulfide/C	0.1 M $KHCO_3$	−0.68	94.2% 91.8%	9.4 (at -0.96 V) 7.8 (at -0.96 V)	61
Nanoporous Au_3Cu	0.1 M $KHCO_3$	−0.7	98.12%	12.77	62

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