Supporting Information For

In Situ Confinement of Pt within Three-Dimensional MoO_2@Porous Carbon for Efficient Hydrogen Evolution

Yimin Jiang*, Miao Yang, Meijiao Qu, Yi Wang, Zhouchunyu Yang, Qingliang Feng*, Xia Deng, Wei Shen, Ming Li, Rongxing He*

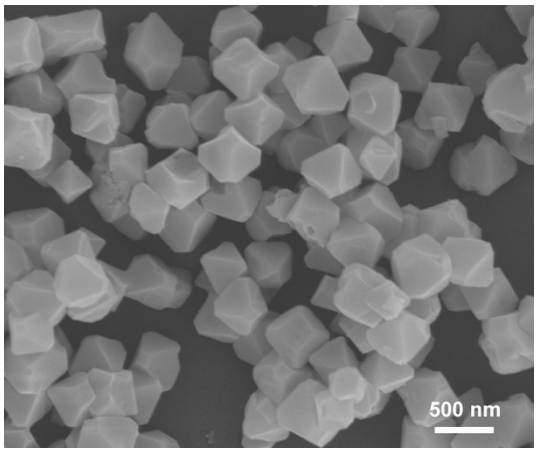

Figure S1 SEM image of as-prepared NENU-5 octahedrons.

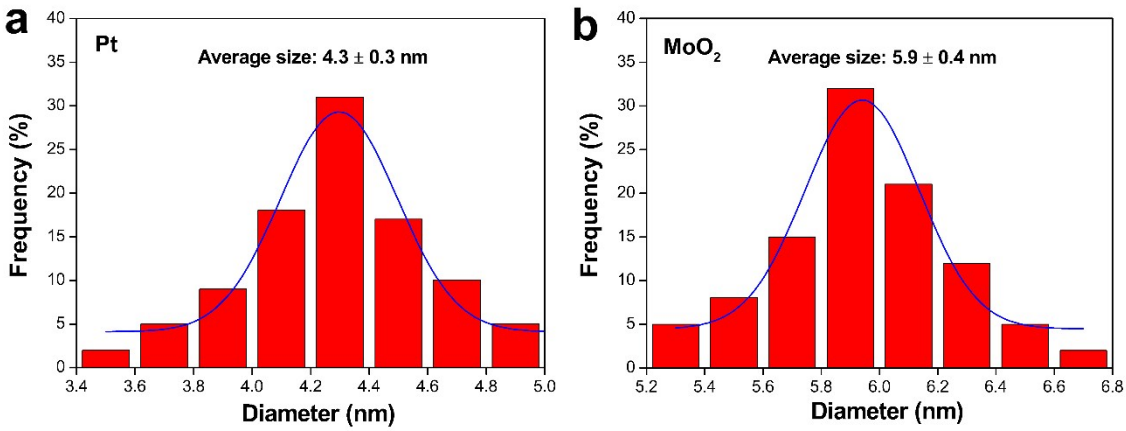

Figure S2 Size distributions of Pt (a) and MoO_2 (b) nanoparticles in the Pt-MoO_2@PC octahedrons.

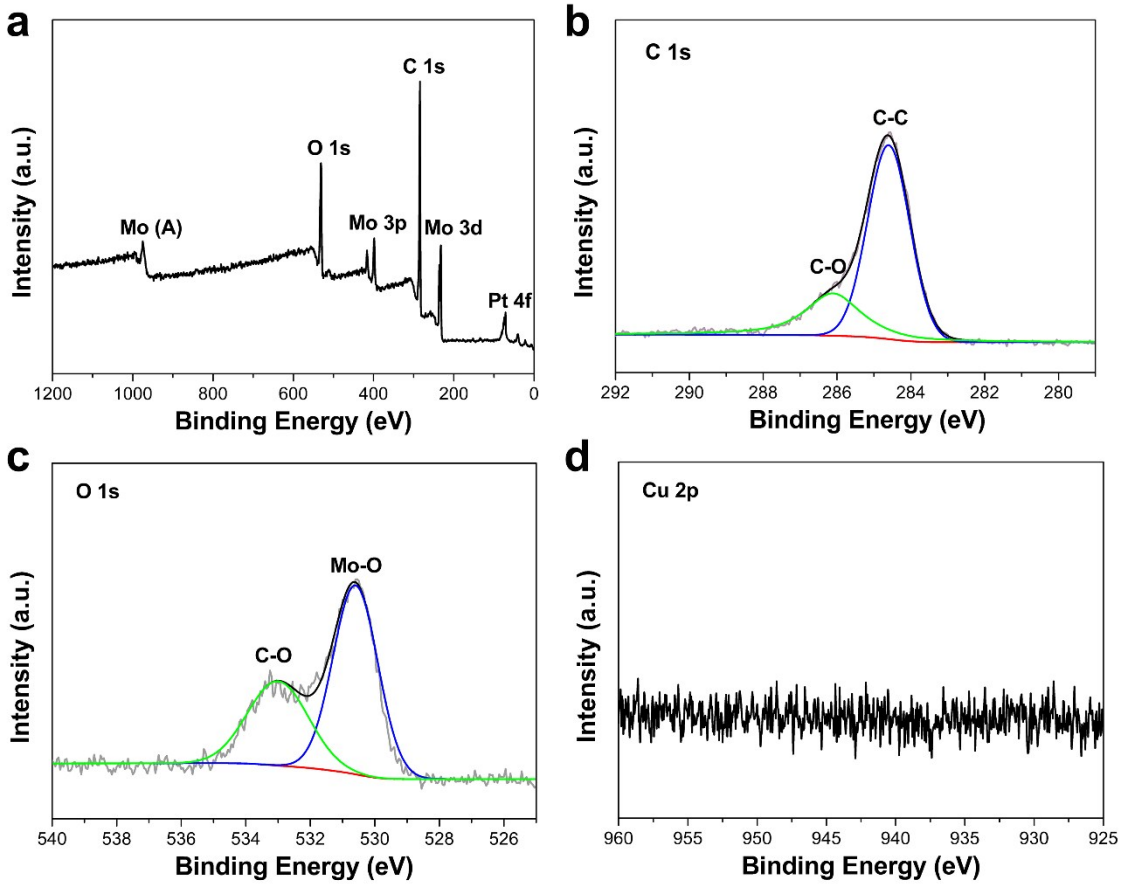

Figure S3 XPS spectra of the Pt-MoO_2@PC octahedrons: (a) survey spectrum; (b) C 1s; (c) O 1s; (d) Cu 2p.

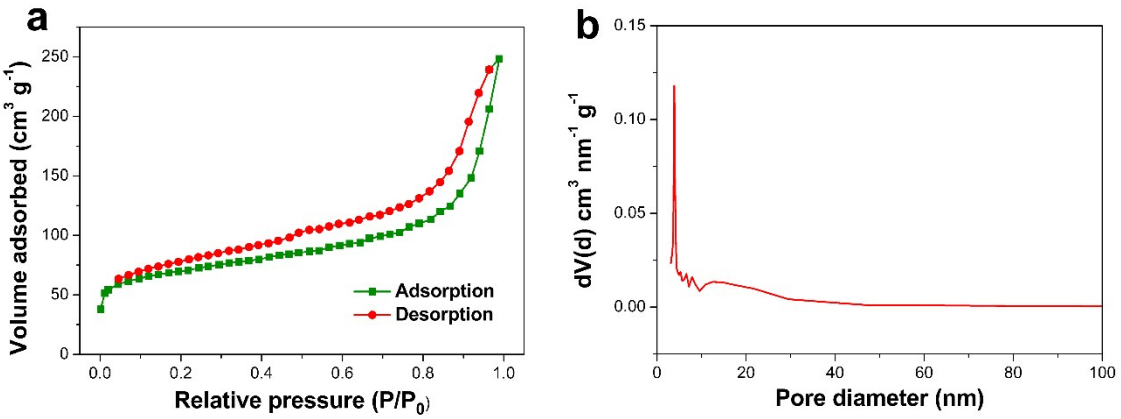

Figure S4 (a) N_2 adsorption/desorption isotherms; (b) the corresponding pore size distribution of the Pt-MoO_2@PC octahedrons.

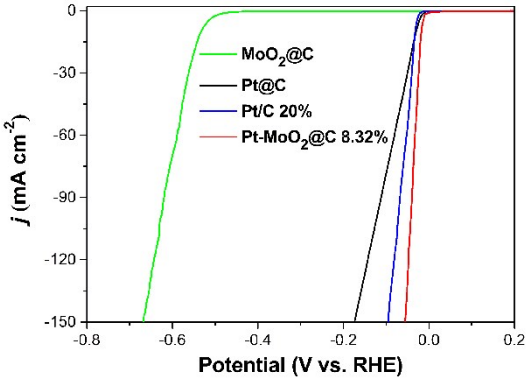

Figure S5 Polarization curves of the MoO_2@PC, Pt@PC, Pt-MoO_2@PC and 20 wt% Pt/C in 0.5 M H_2SO_4 using a GC electrode with a diameter of 5 mm.

Table S1 Comparison of HER activities for the Pt-MoO_2@PC octahedrons and other HER catalysts.

Catalysts	Pt amount (μg_{Pt} cm^{-2})	η_{10}	Tafel slope (mV dec^{-1})	Mass activity at – 0.05 V (mA μg_{Pt}^{-1})	Reference
Pt@PCM[a]	0.7	105	65.3	0.12	1
Pt-MoS_2	36.0	60	96	—	2
Mo_2C@NC@Pt	21.0	27	28	—	3
Pt/BCF[b]	1.1	55	32	—	4
Pt-MoO_2/CNTs	2.4	60	43	—	5
Ru-MoO_2	45.2[c]	55	44	—	6
MoP@PC	—	58	59	—	7
MoN-NC	—	62	54	—	8
Pt/MoO_2	17.9	47	32.6	7.43	9

CDs/Pt-PANI[d]	8.1	30	41.7	3.80	10
Pt@MoS_2	16.7	70	36	—	11
CuPdPt/C	0.3	48	25	7.15	12
Pd@PdPt	59.6	39	38	—	13
Pt/C	28.0	30	31	1.68	This
Pt-MoO_2@PC	11.6	20	22	11.34	This

[a] Pt atom in the nitrogen-containing porous carbon matrix

[b] bacterial cellulose derived carbon nanofiber

[c] the amount of Ru

[d] carbon dots/Pt modified polyaniline nanosheets

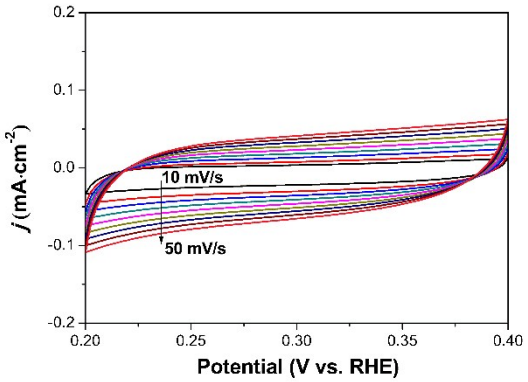

Figure S6 CV curves of 20 wt% Pt/C in the region of 0.2 to 0.4 V with scan rates from 10 to 50 mV s^{-1}.

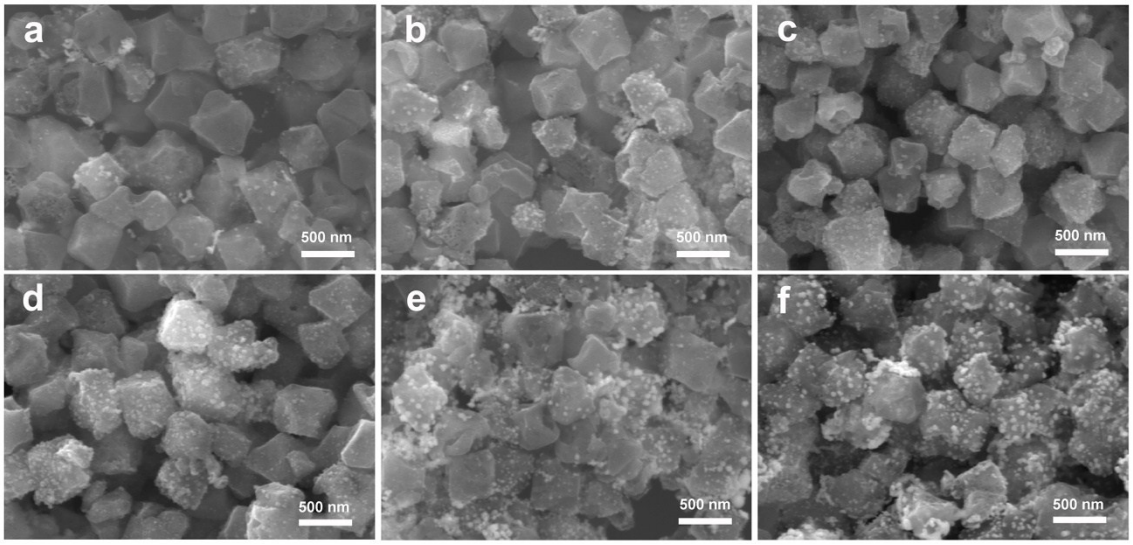

Figure S7 SEM images of the Pt-MoO_2@PC octahedrons with different Pt amounts (wt%): (a) 1.39, (b) 3.88, (c) 6.21, (d) 10.91, (e) 12.76, (f) 13.96.

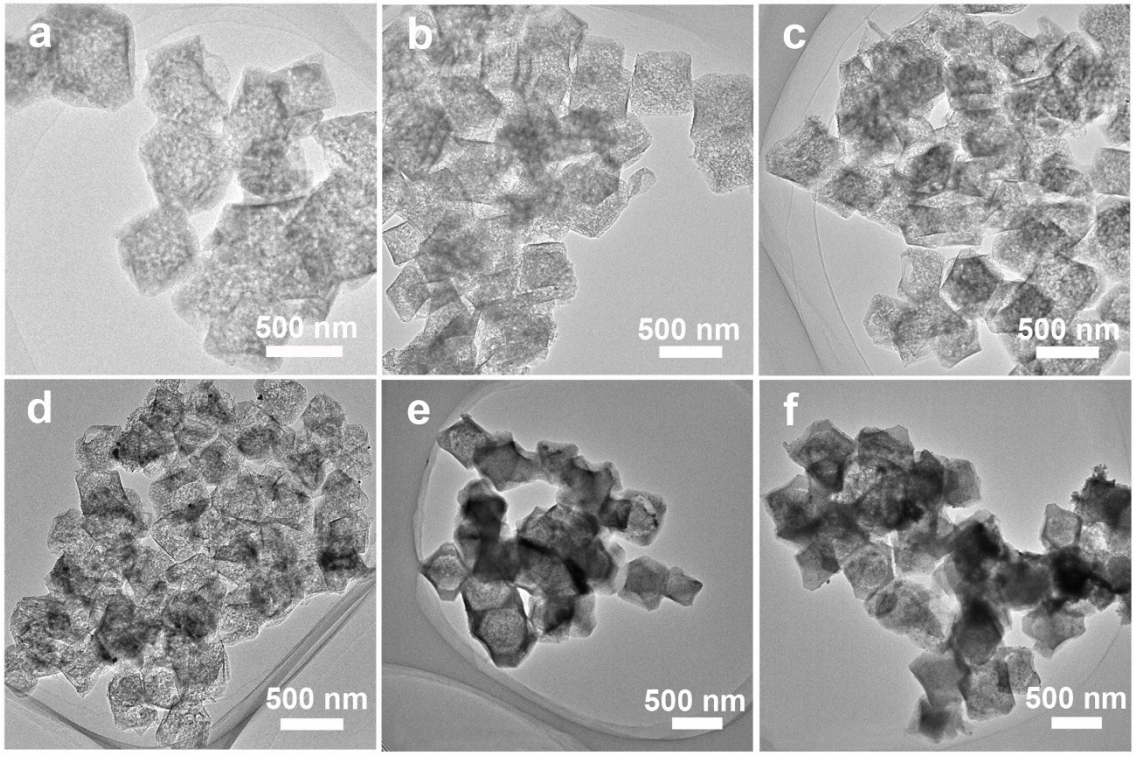

Figure S8 TEM images of the Pt-MoO_2@PC octahedrons with different Pt amounts (wt%): (a) 1.39, (b) 3.88, (c) 6.21, (d) 10.91, (e) 12.76, (f) 13.96.

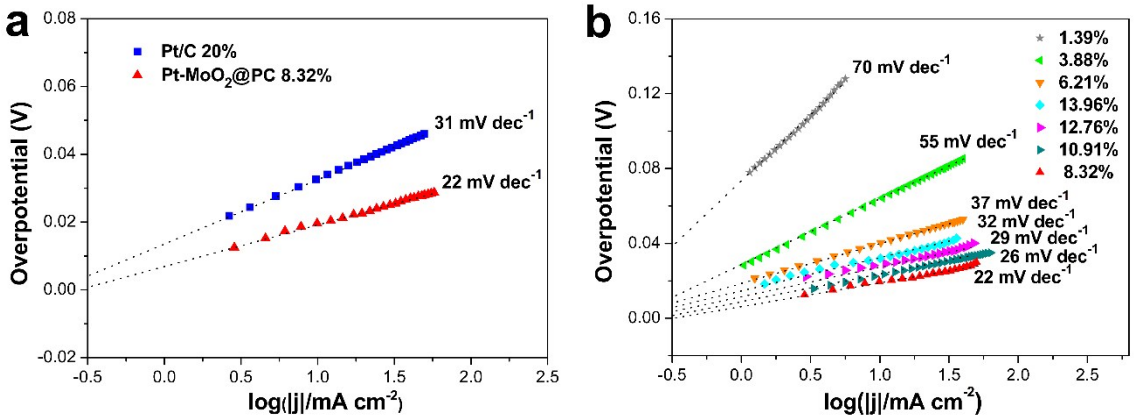

Figure S9 Calculated exchange current densities j_0 of Pt/C (a) and various Pt-MoO_2@PC samples (b) by using the extrapolation method.

Table S2 HER parameters of 20 wt% Pt/C and various Pt-MoO_2@PC samples.

Samples	Tafel slope (mV dec^{-1})	j_0 (mA cm^{-2})
Pt/C	31	0.38
1.39%	70	0.05
3.88%	55	0.22
6.21%	37	0.36
8.32%	22	0.59
10.91%	26	0.45
12.76%	29	0.40
13.96%	32	0.37

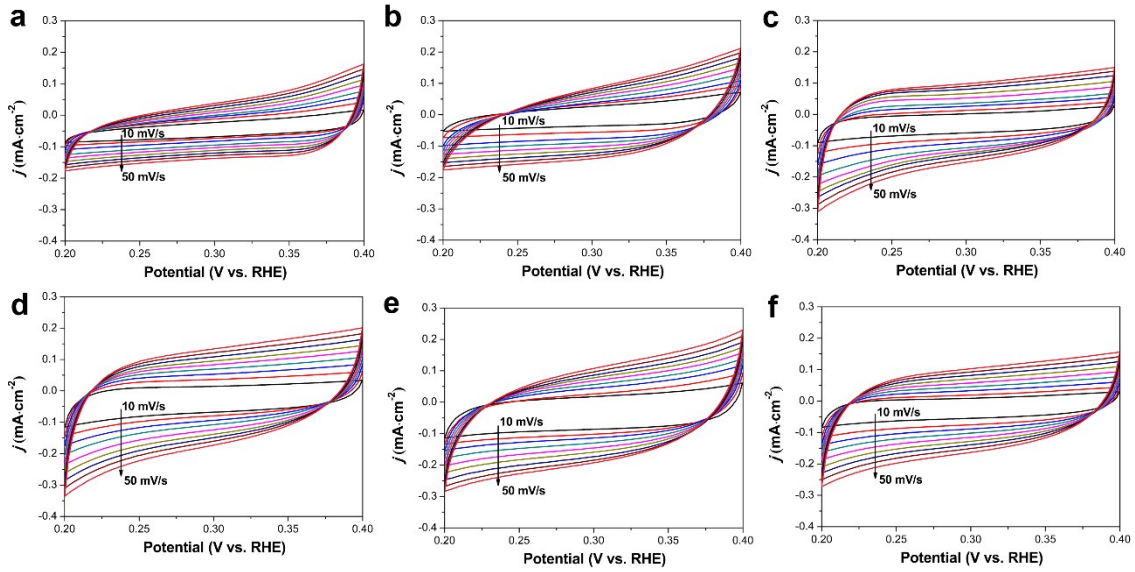

Figure S10 CV curves of the Pt-MoO_2@PC octahedrons with different Pt amounts in the region of 0.2 to 0.4 V with scan rates from 10 to 50 mV s^{-1}: (a) 1.39, (b) 3.88, (c) 6.21, (d) 10.91, (e) 12.76, (f) 13.96.

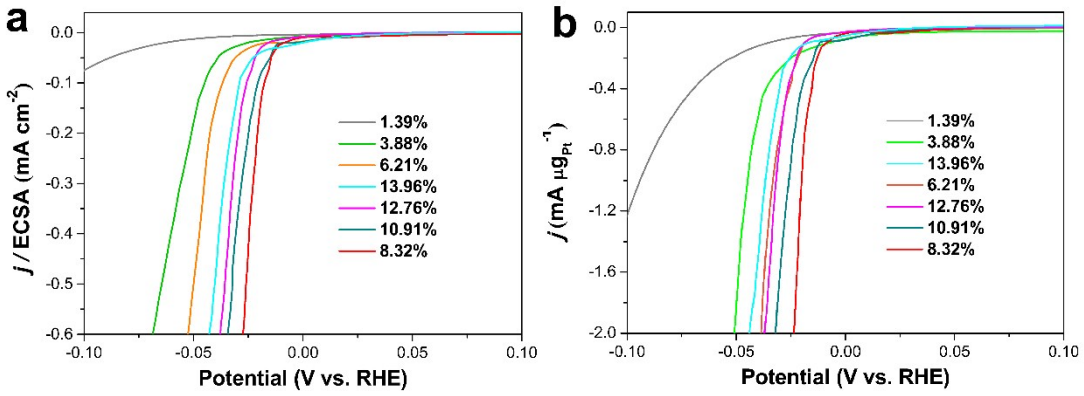

Figure S11 Polarization curves normalized by the ECSA (a) and Pt amount (b) for the Pt-MoO_2@PC samples with different Pt amounts.

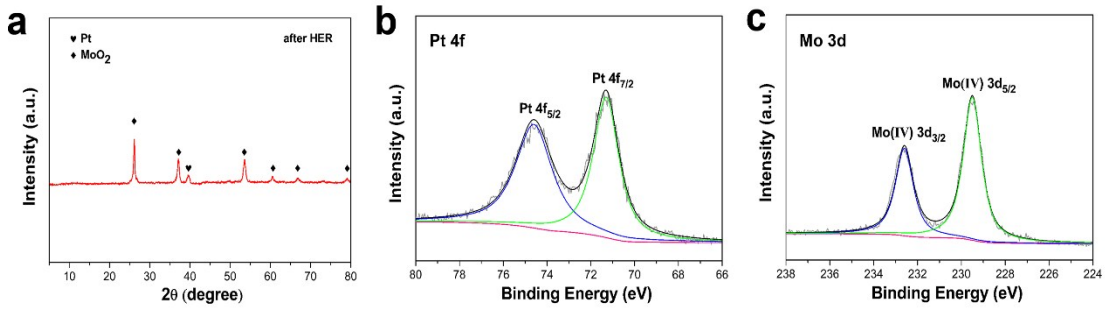

Figure S12 (a) XRD pattern, (b) Pt 4f and (c) Mo 3d spectra of the Pt-MoO_2@PC octahedrons after 1000 potential sweeps in 0.5 M H_2SO_4.

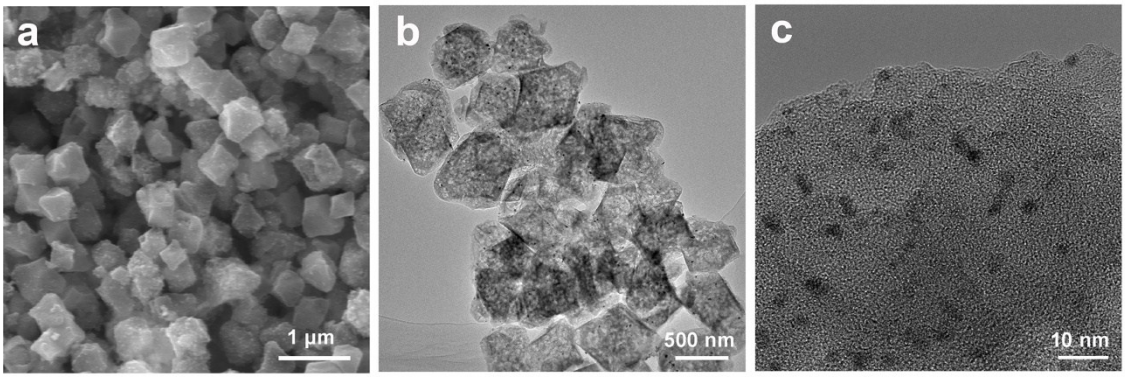

Figure S13 (a) SEM, (b) TEM and (c) HRTEM images of the Pt-MoO_2@PC octahedrons after 1000 potential sweeps in 0.5 M H_2SO_4.

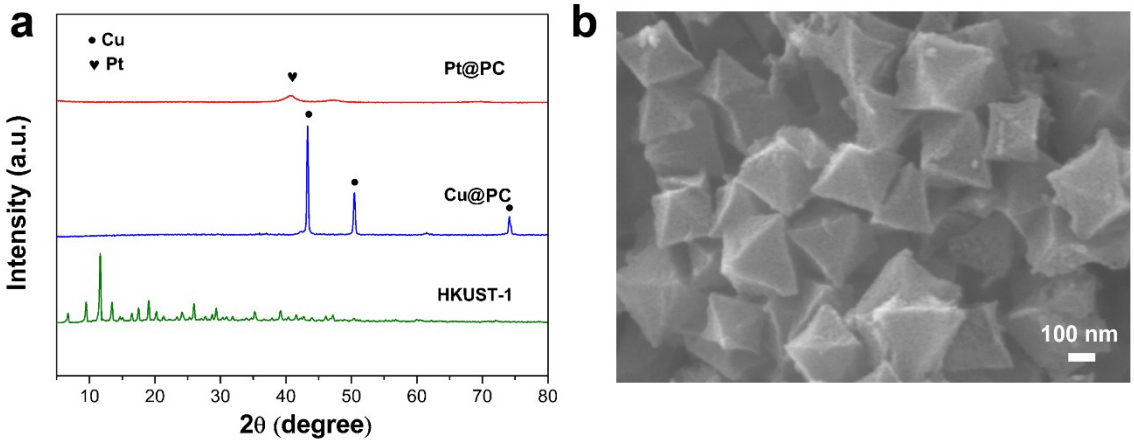

Figure S14 (a) XRD patterns of HKUST-1, Cu@PC and Pt@PC samples; (b) SEM image of the Pt@PC octahedrons.

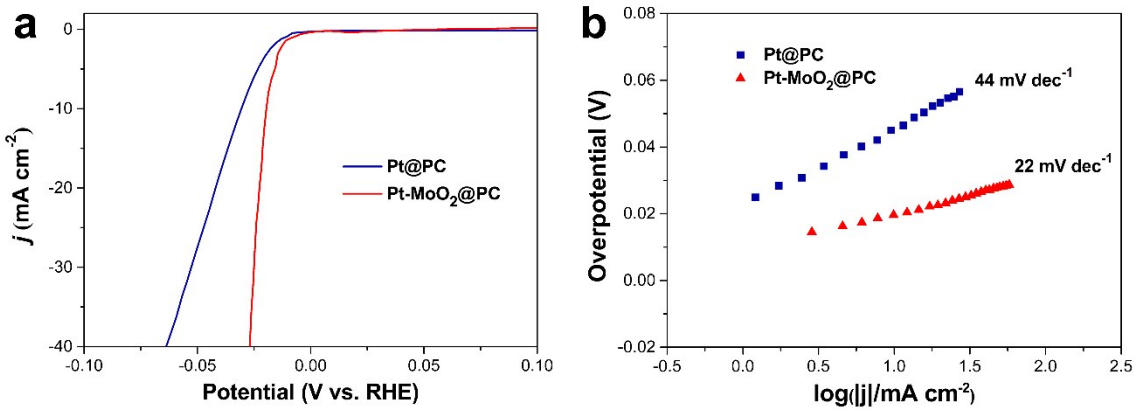

Figure S15 (a) Polarization curves and (b) Tafel plots of the Pt@PC and Pt-MoO_2@PC octahedrons.

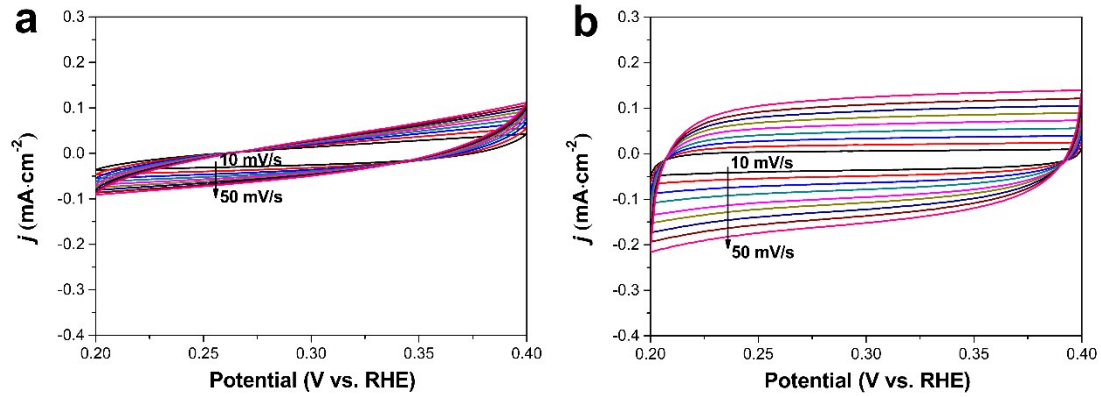

Figure S16 CV curves of the (a) MoO_2@PC and (b) Pt@PC octahedrons in the region of 0.2 to 0.4 V with scan rates from 10 to 50 mV s^{-1}.

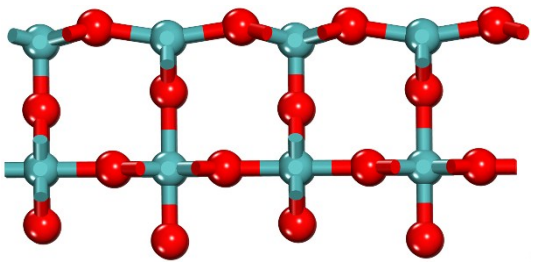

Figure S17 Geometric configurations of MoO_2.

Notes and references

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