Electronic Supplementary Information for

In situ embedding Mo_2C/MoO_{3-x} nanoparticles within a carbonized wood membrane as a self-supported pH-compatible cathode for efficient electrocatalytic H_2 evolution

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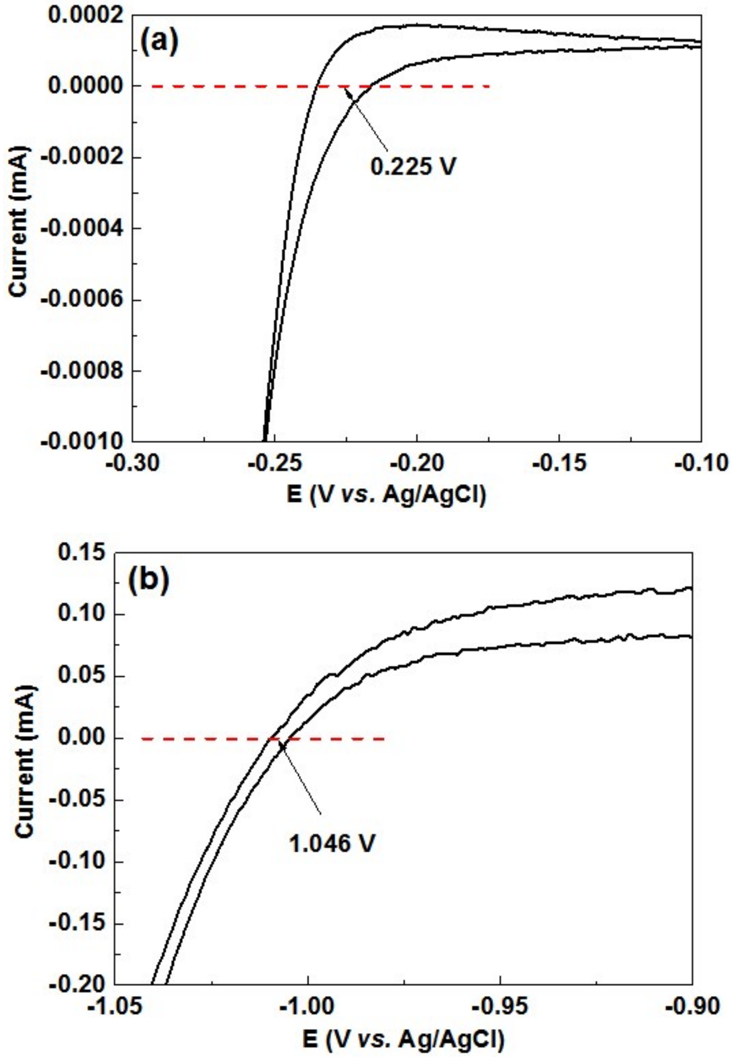

Fig. S1 (a) The cyclic voltammograms (CV) of Pt wire working electrode in the high purity hydrogen saturated 0.5 M H_2SO_4 and (b) 1 M KOH electrolyte solution. The CV scans were run at a scan rate of 5 mV s^{-1}, and the average of the two potentials at which the current crossed zero was taken to be the thermodynamic potential for the hydrogen electrode.

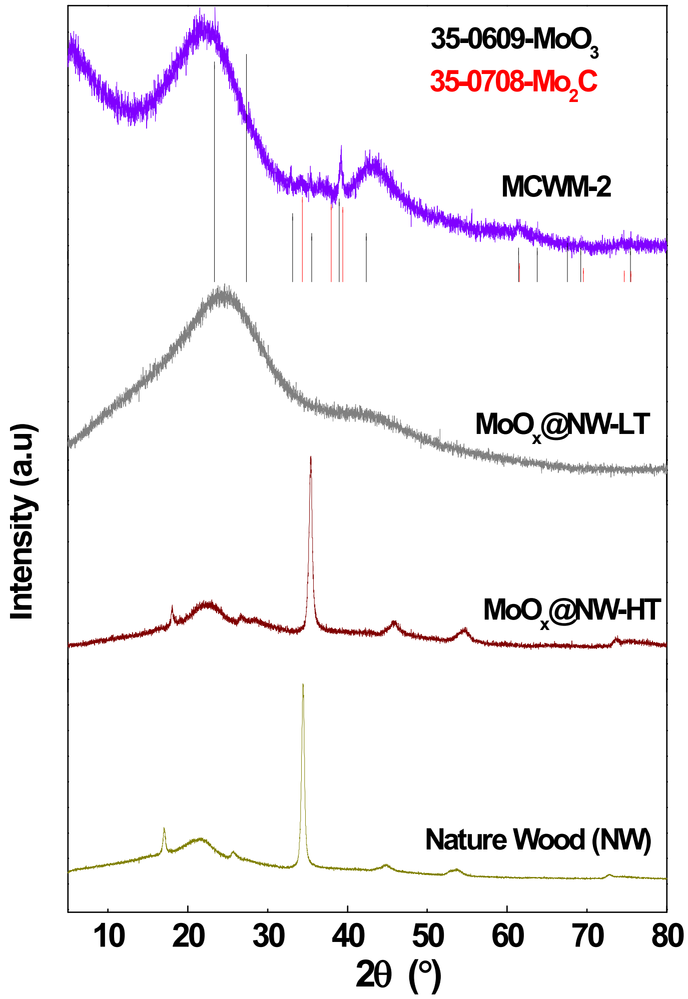

Fig.S2 XRD patterns of the NW, MoO_x@NW-HT, MoO_x@NW-LT, and MCWM-2 electrode. The marks "I", "II", and "III" in the XRD spectrum of the NW slice indicate the diffraction peaks of (002) planes (I) and amorphous phase (II) of the cellulose and crystalline hemicellulose (III), respectively.

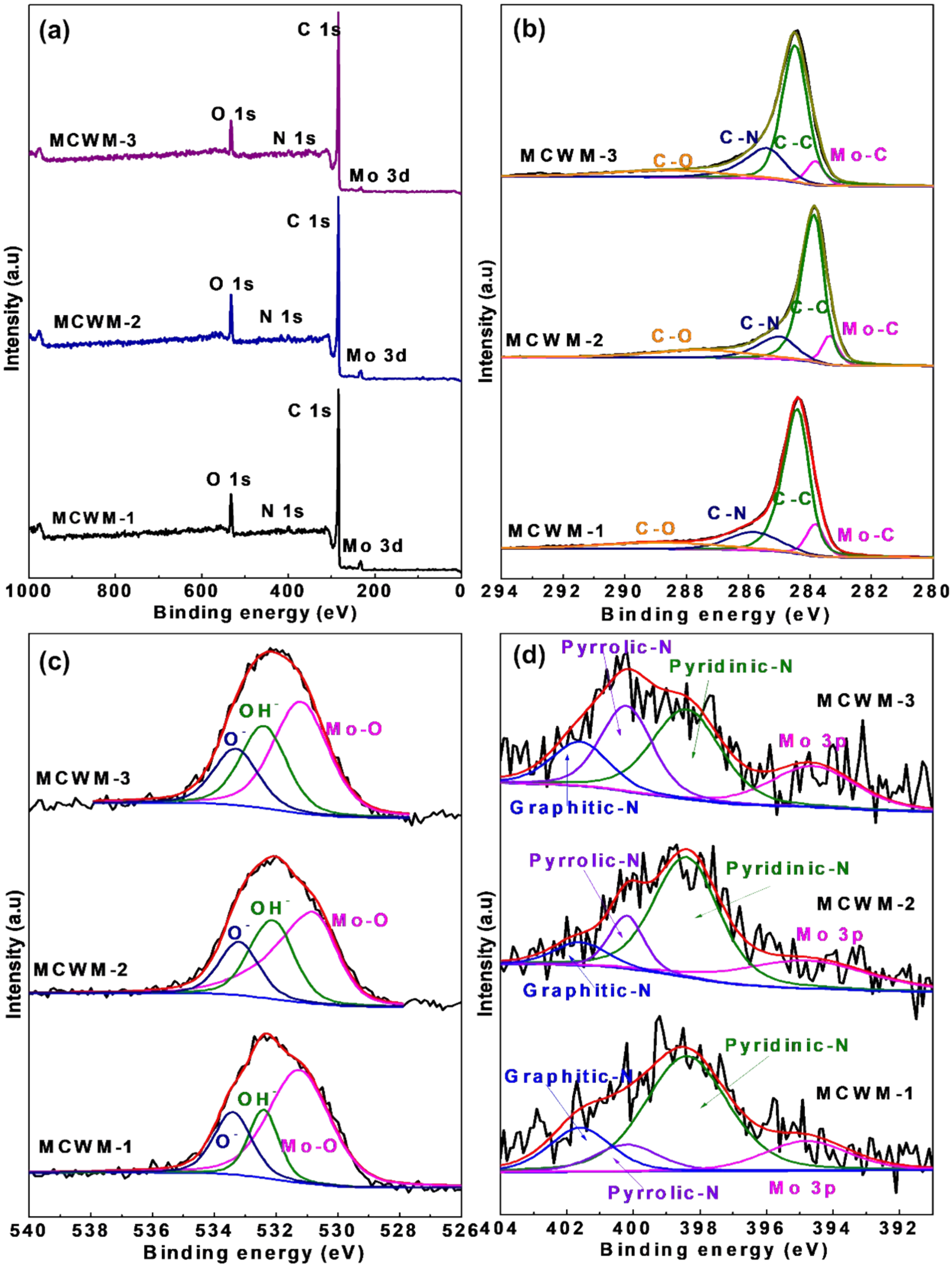

Fig. S3 (a) XPS survey spectra. High-resolution (b) C 1s, (c) O 1s, and (d) N 1s XPS spectra of the MCWM-1, MCWM-2 and MCWM-3 electrodes.

Table S1 ICP-OES analysis for the MCWM electrodes.

Sample	Loading amount of Mo (mg cm^{-2})
MCWM-1	0.5933
MCWM-2	0.5965
MCWM-3	0.5980

Table S2 The summary of content for different Mo species in different electrodes.

Sample	Mo_2C	MoO_{3-x}		Mo_2C/Mo_{3-x}
		Mo^{5+}	Mo^{6+}	
MCWM-1	15.03%	4.97%	80.00%	0.186
MCWM-2	10.40%	5.21%	84.39%	0.116
MCWM-3	25.93%	5.99%	68.08%	0.350
MCWM-2 after HER stability test in 0.5 M H_2SO_4	27.24%	5.11%	67.65%	0.374
MCWM-2 after HER stability test in 1M KOH	23.24%	5.24%	71.52%	0.303

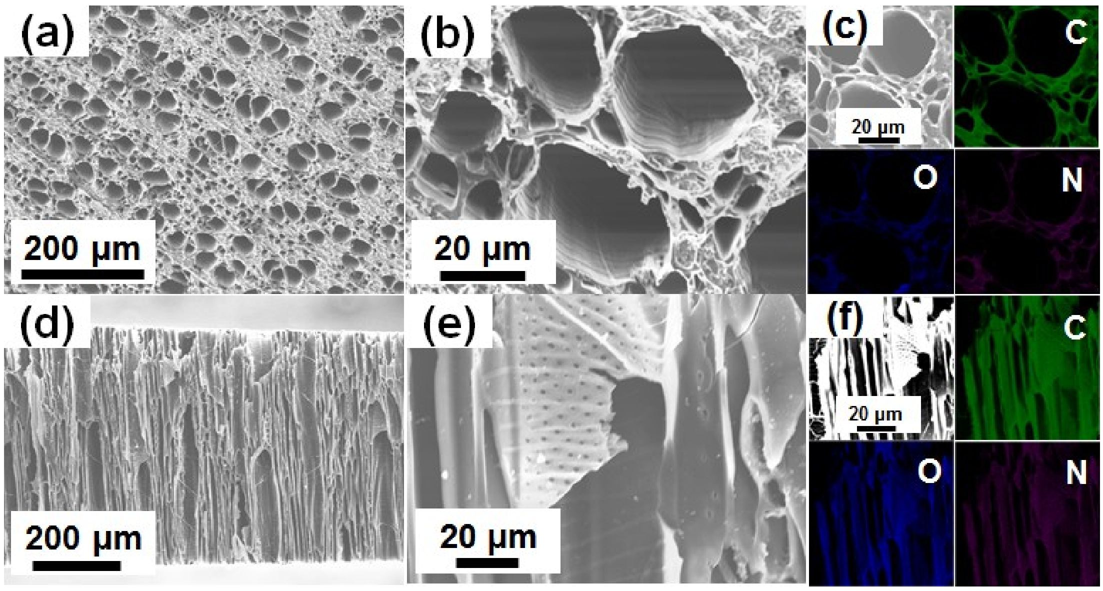

Fig. S4 (a, b) Top-view SEM images of the CWM electrode and (c) the corresponding EDS element mapping images. (d, e) Side-view SEM images of the CWM electrode and (f) the corresponding EDS element mapping images.

Table S3. HER activities of various non-noble metal electrocatalysts in 0.5 M H_2SO_4 solution.

Sample	Overpotential (mV) at 10 mA cm^{-2}	Tafel slop (mV dec^{-1})	Self-supported	Reference
MCWM-2	186	134	Yes	This work
MoP NA/CC	124	58	Yes	1
Mo_2C@NC	60	-	No	2
MoC@GC	124	43	No	3
N,P-Doped Mo_2C@C	141	71	No	4
P-MoO_{3-x}	166	42	No	5
Mesoporous MoO_{3-x}	179	72	No	6
α-Mo_2C	198	56	No	7
Mo_2C/GCSs	200	62.5	No	8
Mo_2C	208	56	No	9
Mo_2N/CNT	218	133	No	10
MoP	246	60	No	11
MoC_2 NWAs/CFP	190	68	Yes	12

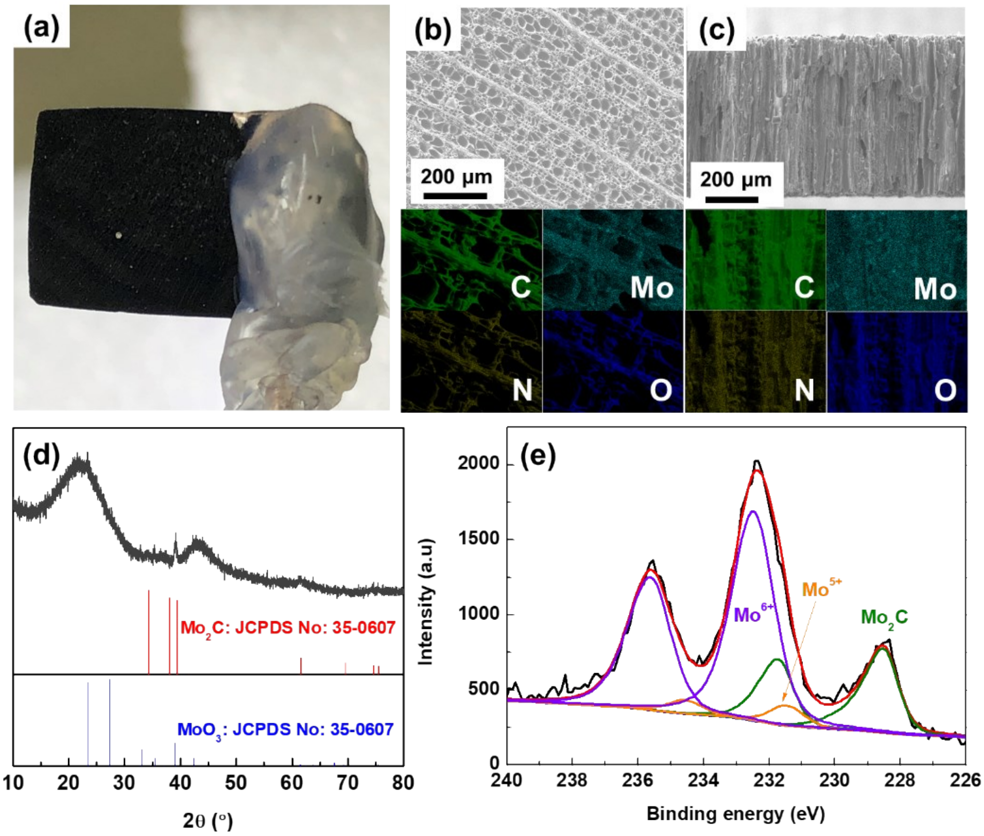

Fig. S5 (a) Digital photo of the MCWM-2 electrode after a 12 h of HER stability test in 0.5 M H_2SO_4. (b) Top-view and (c) side-view SEM images of the MCWM-2 electrode and the corresponding EDX elemental maps. (d) XRD pattern and (e) Mo3d XPS spectrum of the used MCWM-2 electrode after a 12 h of HER stability test in 0.5 M H_2SO_4.

Table S4 HER activities of various non-noble metal electrocatalysts in 1.0 M KOH solution.

Sample	Overpotential (mV) at 10 mA cm^{-2}	Tafel slop (mV dec^{-1})	Self-supported	Reference
MCWM-2	275.3	134	Yes	This work
MoC_2 NWAs/CFP	170	72	Yes	12
γ- Mo_2N@NC	85	54	No	13
Mo_2C/carbon Microflowers	100	65	No	14
Mo_2C@NC	124	60	No	15
MoC_x	151	59	No	16
MoC@NC	170	51	No	17
Mo_2C	190	54	No	9
P-MoO_{3-x}	233	53	No	5
Core-shell MoO_3-MoS_2 nanowires	250	60	No	18
Mo_2C	290	216	No	19
MoO_2/rGO	310	68	No	20
Mo_2C/NGA	365	-	Yes	21

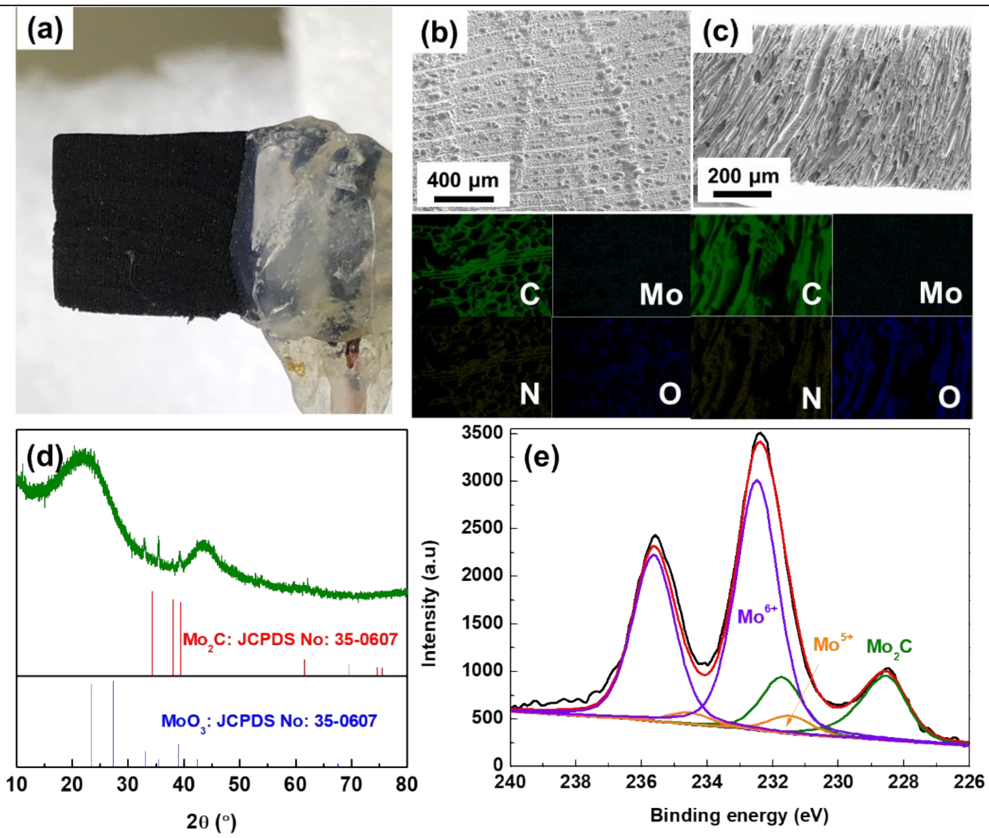

Fig. S6 (a) Digital photo of the MCWM-2 electrode after a 12 h of HER stability test in 1.0 M KOH. (b) Top-view and (c) side-view SEM images of the MCWM-2 electrode and the corresponding EDX elemental maps. (d) XRD pattern and (e) Mo3d XPS spectrum of the used MCWM-2 electrode after a 12 h of HER stability test in 1.0 M KOH.

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