Supporting Information

MoO_2 nanosheets anchored with Co nanoparticles as a bifunctional electrocatalytic platform for overall water splitting

Lu Xia [a], Yanjun Li [a], Hao Song [b,c], Xingxing Li [b], Wenjie Gong [a], Xinyu Jiang [a], Mehran Javanbakht [d], Xuming Zhang [b], Biao Gao [b,*], Paul K. Chu [c,*]

[a] The College of Resources and Environment Engineering and Hubei Key Laboratory for Efficient Utilization and Agglomeration of Metallurgic Mineral Resources, Wuhan University of Science and Technology, Wuhan 430081, China

[b] The State Key Laboratory of Refractories and Metallurgy and Institute of Advanced Materials and Nanotechnology, Wuhan University of Science and Technology, Wuhan 430081, China

[c] Department of Physics, Department of Materials Science and Engineering, and Department of Biomedical Engineering, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, China

[d] Renewable Energy Research Center, Amirkabir University of Technology, Tehran, Iran

[*] Corresponding authors: gaobiao@wust.edu.cn (B. Gao); paul.chu@cityu.edu.hk (P.K. Chu)

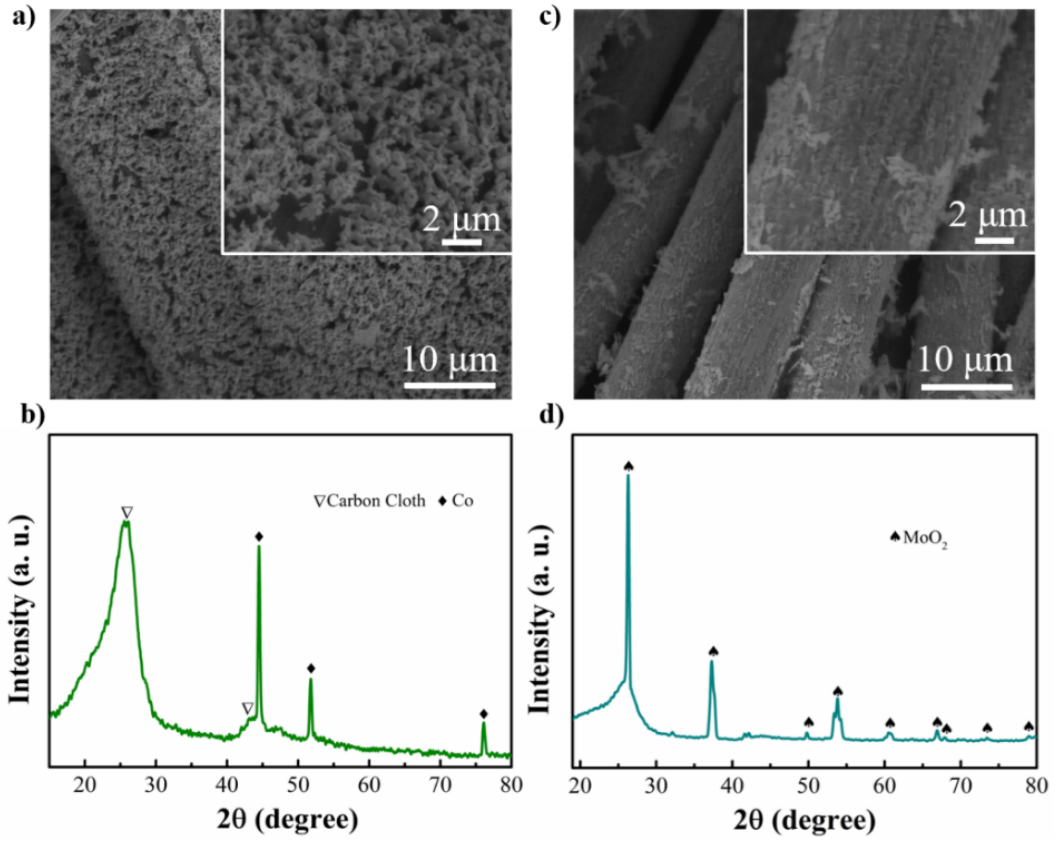

Fig. S1. FE-SEM images of (a) Co and (c) MoO_2 and XRD patterns of (b) Co and (d) MoO_2.

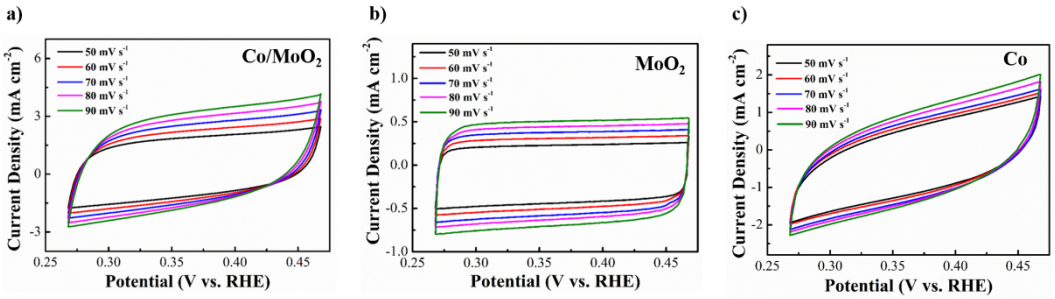

Fig. S2. Electrochemical double-layer capacitances and CV curves acquired at different scanning rates: (a) Co/MoO_2, (b) MoO_2, and (c) Co.

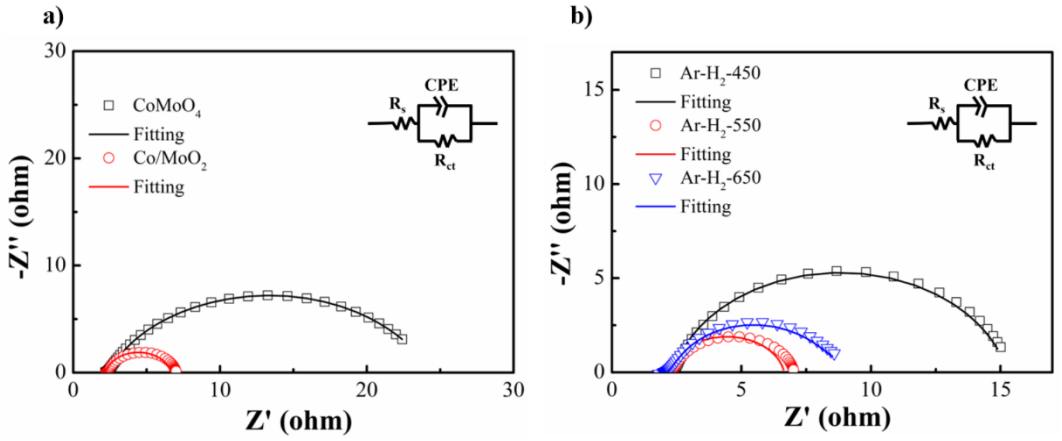

Fig. S3. Nyquist plots collected at 500 mV vs. SCE from (a) $CoMoO_4$ and Co/MoO_2 as well as (b) Co/MoO_2 at different temperature.

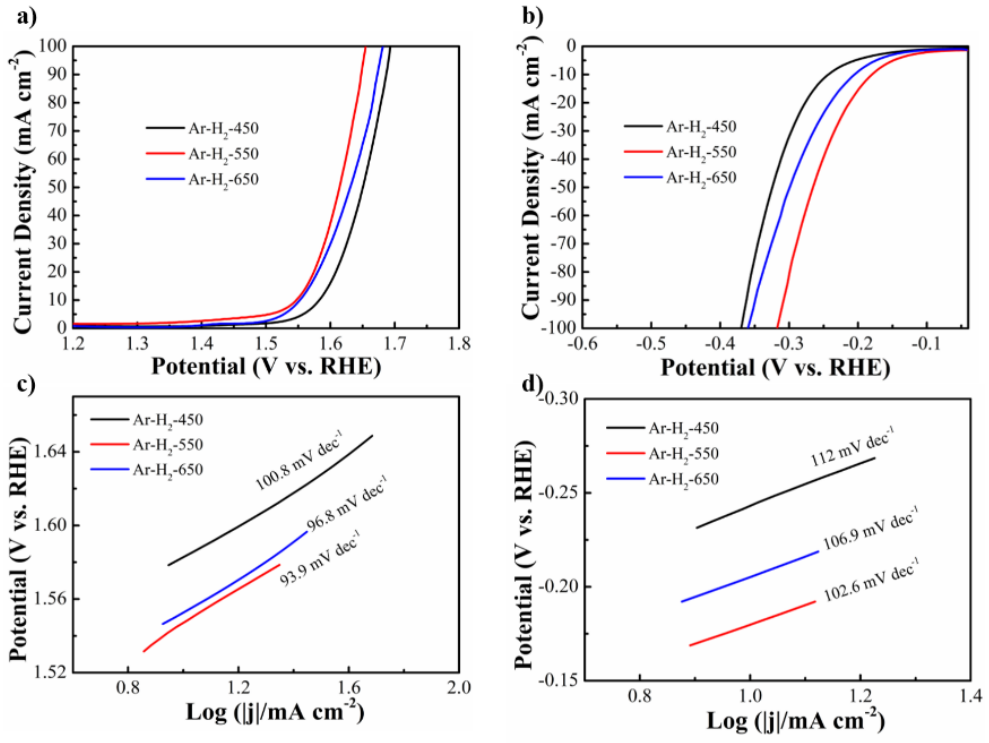

Fig. S4. (a) OER polarization curves of Co/MoO_2 at different temperature, (b) HER polarization curves of Co/MoO_2 at different temperature, (c) Tafel slopes in OER, and (d) Tafel slopes in HER.

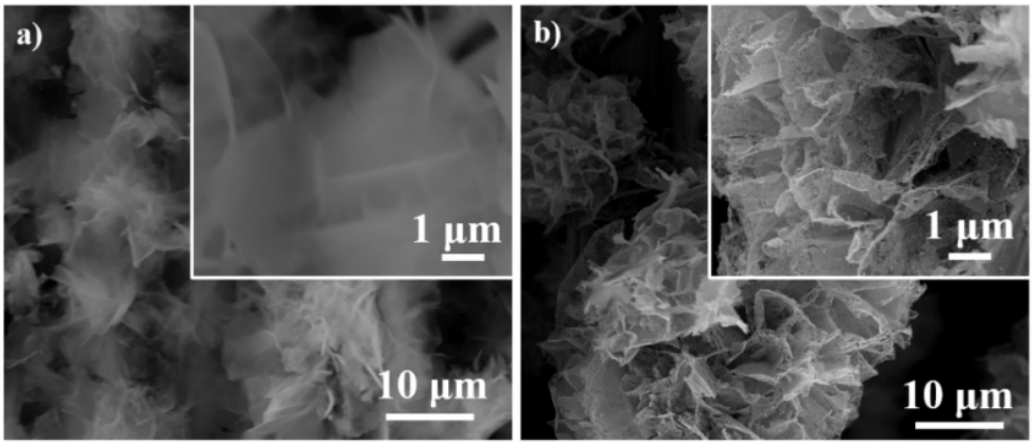

Fig. S5. FE-SEM images of (a) Co/MoO_2-450 and (b) Co/MoO_2-650.

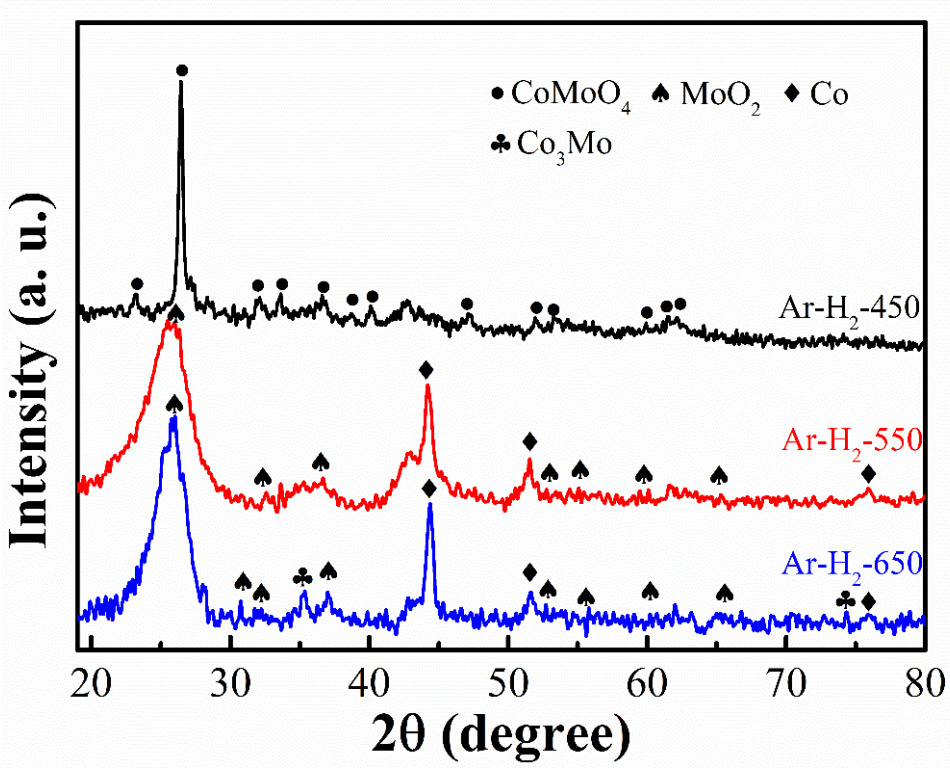

Fig. S6. XRD patterns of Co/MoO_2 at different temperature.

Table S1. Comparison of OER characteristics of recently reported non-noble electrocatalysts in alkaline media.

Catalysts	Electrolytes	η_{10} (mV vs.RHE)	References
$Co/MoO_2/CC$	1M KOH	318	This work
$CoMoO_4/CC$	1M KOH	355	This work
MoO_2/NF	1M KOH	350	*ACS Sustainable Chem Eng, 2019, 7, 9153-9163.*
MoO_{2+OH^-}	1M KOH	435	*ACS Appl Energy Mater, 2020, 3, 5208-5218.*
MoO_2-Co	1M KOH	378	*Appl Surf Sci, 2021, 543, 148804.*
MoO_2-$Co_2Mo_3O_8$@C	1M KOH	320	*Chem Commun, 2018, 54, 2739-2742.*
$Co_2N_{0.67}$-BHPC	1M KOH	340	*J Energy Chem, 2021, 54, 626-638.*
Co/β-Mo_2C@N-CNTs	1M KOH	356	*Angew Chem Int Ed, 2019, 58, 4923-4928.*

Table S2. Comparison of HER characteristics of recently reported non-noble electrocatalysts in alkaline media.

Catalysts	Electrolytes	η_{10} (mV vs.RHE)	References
Co/MoO_2/CC	1M KOH	178	This work
$CoMoO_4$/CC	1M KOH	272	This work
MoO_2	1M KOH	200	*Electrochim Acta, 2020, 359, 136929.*
MoO_2/NF	1M KOH	187	*ACS Sustainable Chem Eng, 2019, 7, 9153-9163.*
Co@β-Mo_2C-NC-0.115	1M KOH	188	*J Electrochem Soc, 2020, 167, 044520.*
MoO_2-Co	1M KOH	422	*Appl Surf Sci, 2021, 543, 148804.*
Co-CoO/BC	1M KOH	210	*Int J Hydrogen Energ, 2019, 44, 6525-6534.*
Mo_2C/MoO_2	1M KOH	204	*ACS Sustainable Chem Eng, 2018, 6, 14356-14364.*

Table S3. Comparison of the overall water splitting properties of recently reported non-noble electrocatalysts in alkaline media.

Catalysts	Electrolytes	Current density j (mA cm^{-2})	Voltage of overall water splitting (V)	Refs.
$Co/MoO_2/CC$	1 M KOH	10	1.72	This work
Co@β-Mo_2C-NC-0.115	1 M KOH	10	1.72	*J Electrochem Soc*, 2020, 167, 044520.
$Co_2P/Mo_2C/Mo_3Co_3C$@C	1 M KOH	10	1.74	J Mater Chem A, 2018, 6, 5789-5796.
Co-CoO/BC	1 M KOH	10	1.77	*Int J Hydrogen Energ*, 2019, 44, 6525-6534.
P-MoO_2	1 M KOH	10	1.83	*Fuel*, 2023, 332, 126250.
$NiO/NiFe_2O_4$	1 M KOH	10	1.82	*Small*, 2021, 17, 2103501.