Supporting Information

CoO_x/UiO-66 and NiO/UiO-66 Heterostructures with UiO-66 Frameworks for Enhanced Oxygen Evolution Reactions

Victor Charles,[a,b,#] Yong Yang,[a,#] Menglei Yuan, [a,b] Jitao Zhang,[f] Yaling Li,[f] Jingxian Zhang,[a,b] Tongkun Zhao,[a,b] Zhanjun Liu[c], Bin Li[d]*, Guangjin Zhang,[a,b,e]*

[a]CAS Key Laboratory of Green Process and Engineering, Institute of Process Engineering, Chinese Academy of Sciences, 100190, Beijing, China. E-mail: zhanggj@ipe.ac.cn

[b]Center of Materials Science and Optoelectronics Engineering, University of Chinese Academy of Sciences, 100049, Beijing, China

[c]CAS Key Laboratory of Carbon Materials, Institute of Coal Chemistry, Chinese Academy of Sciences, Taiyuan, 030001, China

[d]Zhengzhou Tobacco Research Institute of CNTC, No 2 Fengyang Street, Zhengzhou High-Tech Development District, Henan, China, 450001, E-mail: lib@ztri.com.cn

[e]Chemistry and Chemical Engineering Guangdong Laboratory, Shantou, 515031 China

[f]Beijing Engineering Research Center of Printed Electronics, Beijing Institute of Graphic Communication, Beijing, China

[#]Equal contribution

$$M + OH^- \rightarrow M\text{-}OH^- + e^- \quad (1)$$

$$M\text{-}OH^- + OH^- \rightarrow M\text{-}O + H^+ + e^- \quad (2)$$

$$M\text{-}O + OH^- \rightarrow M\text{-}OOH + e^- \quad (3)$$

$$M\text{-}OOH + OH^- \rightarrow M + O_{2(g)} + H^+ + e^- \quad (4)$$

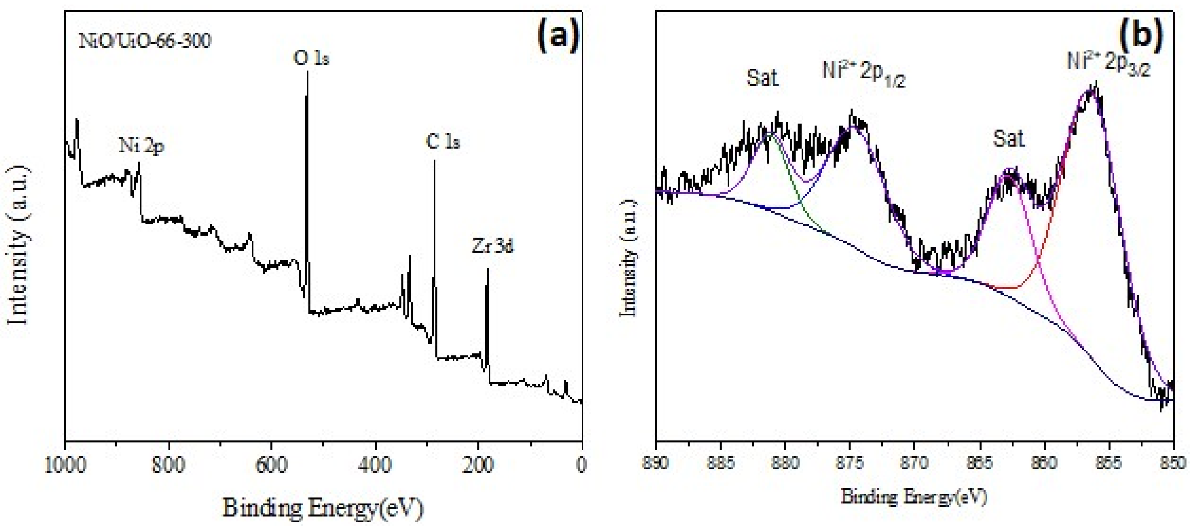


Figure S1. (a) Survey spectrum of NiO/UiO-66-300 and (b) XPS spectra of Ni 2p

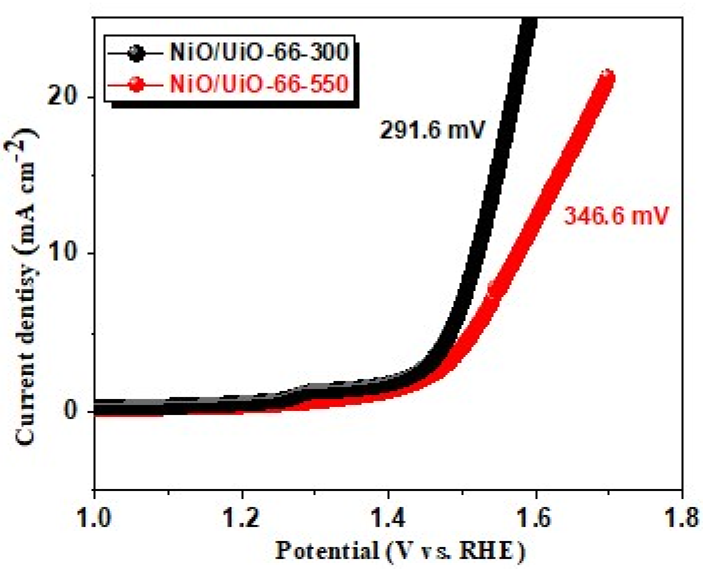


Figure S2. OER polarization curves of NiO/UiO-66-300, and NiO/UiO-66-550

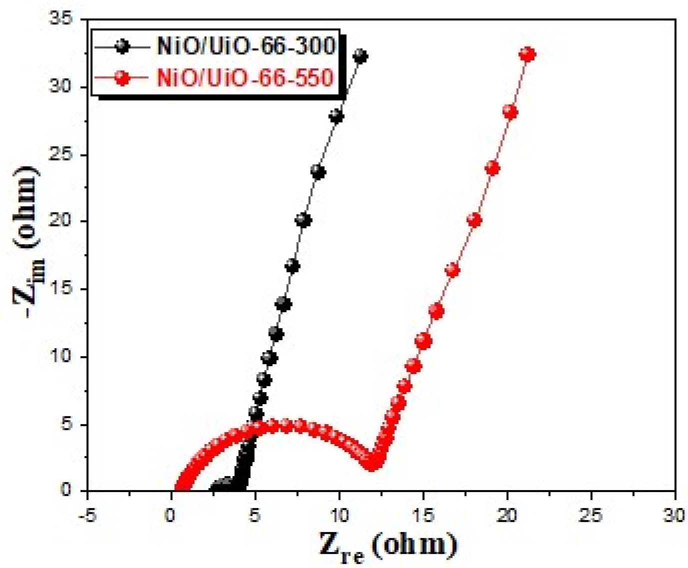
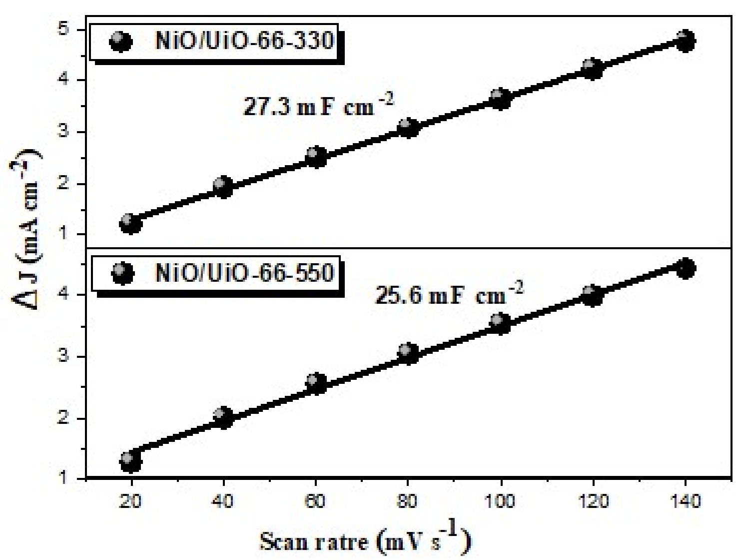


Figure S3. EIS of NiO/UiO-66-300, and NiO/UiO-66-550



Figur S4. C_{di} of NiO/UiO-66-300, and NiO/UiO-66-550

Table S1. OER performance comparisons of some recently published heterostructure catalysts

Catalysts	Mass loading (Mg/cm^2)	Electrolyte	Overpoytential at 10 mA cm^{-2} (mV vs. RHE)	References
CoO_x/UiO-66-300	0.3	1 M KOH	283	This work
NiO/UiO-66-300	0.3	1 M KOH	291	This work
2.5Fe-NiCoP/PBA HNCs	0.2	1 M KOH	290	[1]
RuO_2/CeO_2 heterostructure	0.28	1 M KOH	350	[2]
Co_3O_4/Fe_2O_3 nanocubes	3.0	1 M KOH	310	[3]
Ultrathin Co_3O_4 nanomeshes	~0.34	1 M KOH	307	[4]
Fe-CoOOH/graphene	0.2	1 M KOH	330	[5]
MoS_x- encapsulated $Co(OH)_2$ nanosheets	0.2	0.1 M KOH	350	[6]
Co-BPDC/Co-BDC heterostructure	0.28	1 M KOH	335	[7]
Ni-BDC/$Ni(OH)_2$ heterostructure	-	1 M KOH	320	[8]
Se-$(CoFe)S_2$ heterostructure	-	1 M KOH	281	[9]
Ni-MOF/LDH heterostructure	-	1 M KOH	220	[10]
Ni_3S_2-Co_9S_8 heterostructure	-	1 M KOH	294	[11]
Co_9S_8/Ni_3S_2/NF heterostructure	-	1 M KOH	227	[12]
Ni_3S_2@$Co(OH)_2$/NF heterostructure	-	1 M KOH	290	[13]
NCS-0.5/NF heterostructure	-	1 M KOH	340	[14]
NiO/NiS heterostructure	-	1 M KOH	209	[15]

Supplementary References

1 D. Li, C. Liu, W. Ma, S. Xu, Y. Lu, W. Wei, J. Zhu and D. Jiang, *Electrochim. Acta*, , DOI:10.1016/j.electacta.2020.137492.

2 S. M. Galani, A. Mondal, D. N. Srivastava and A. B. Panda, *Int. J. Hydrogen Energy*, 2020, **45**, 18635–18644.

3 X. Wei, Y. Li, H. Peng, D. Gao, Y. Ou, Y. Yang, J. Hu, Y. Zhang and P. Xiao, *Chem. Eng. J.*, 2019, **355**, 336–340.

4 Y. Li, F. M. Li, X. Y. Meng, S. N. Li, J. H. Zeng and Y. Chen, *ACS Catal.*, 2018, **8**, 1913–1920.

5 X. Han, C. Yu, S. Zhou, C. Zhao, H. Huang, J. Yang, Z. Liu, J. Zhao and J. Qiu, *Adv. Energy Mater.*, , DOI:10.1002/aenm.201602148.

6 F. Sun, C. Li, B. Li and Y. Lin, *J. Mater. Chem. A*, 2017, **5**, 23103–23114.

7 Q. Zha, F. Yuan, G. Qin and Y. Ni, *Inorg. Chem.*, 2020, **59**, 1295–1305.

8 D. Zhu, J. Liu, L. Wang, Y. Du, Y. Zheng, K. Davey and S. Z. Qiao, *Nanoscale*, 2019, **11**, 3599–3605.

9 Y. Song, X. Zhao and Z. H. Liu, *Electrochim. Acta*, 2021, **374**, 137962.

10 W. Da Zhang, Q. T. Hu, L. L. Wang, J. Gao, H. Y. Zhu, X. Yan and Z. G. Gu, *Appl. Catal. B Environ.*, 2021, **286**, 119906.

11 R. Zhang, L. Cheng, Z. Wang, F. Kong, Y. Tsegazab, W. Lv and W. Wang, *Appl. Surf. Sci.*, 2020, **526**, 146753.

12 F. Du, L. Shi, Y. Zhang, T. Li, J. Wang, G. Wen, A. Alsaedi, T. Hayat, Y. Zhou and Z. Zou, *Appl. Catal. B Environ.*, 2019, **253**, 246–252.

13 X. Du, P. Che, Y. Wang, C. Yuan and X. Zhang, *Int. J. Hydrogen Energy*, 2019, **44**, 22955–22961.

14 J. Lin, H. Wang, X. Zheng, Y. Du, C. Zhao, J. Qi, J. Cao, W. Fei and J. Feng, *J. Power Sources*, 2018, **401**, 329–335.

15 N. A. Khan, N. Rashid, M. Junaid, M. N. Zafar, M. Faheem and I. Ahmad, *ACS Appl. Energy Mater.*, 2019, **2**, 3587–3594.