Electronic Supplementary Information

MOF-derived CuCoNi trimetallic hybrids as efficient oxygen evolution reaction electrocatalysts

Junchao Ma,[a] Boyan Lu,[a] Sha Wang,[a] Wenxiu He,[a] Xiaojue Bai,[a] Tieqiang Wang,[a] Xuemin Zhang,[a] Yunong Li,[a] Liying Zhang,[a] Junyi Chen,[b] Fanbao Meng*[a] and Yu Fu*[a]

[a] Department of Chemistry, College of Sciences, Northeastern University, Shenyang 110819, P. R. China.

[b] Engineering Laboratory of Chemical Resources Utilization in South Xinjiang of Xinjiang Production and Construction Corps, College of Life Science, Tarim University, Xinjiang Uygur Autonomous Region, Alaer, 843300, P. R. China.

Corresponding Author

* E-mail: fuyu@mail.neu.edu.cn (Yu Fu)

* E-mail: mengfb@mail.neu.edu.cn (Fanbao Meng)

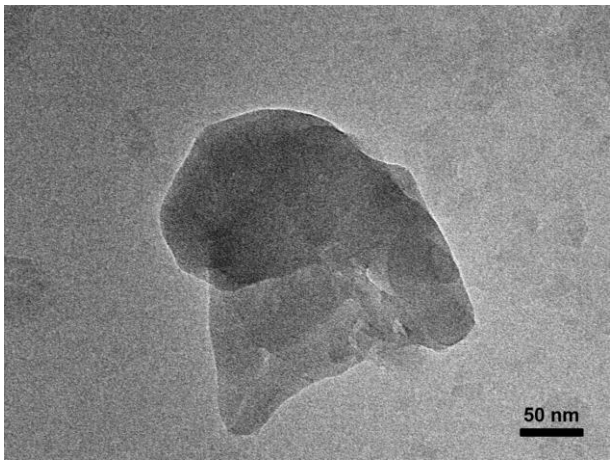

Fig. S1 TEM image of CoNi-Cu(BDC).

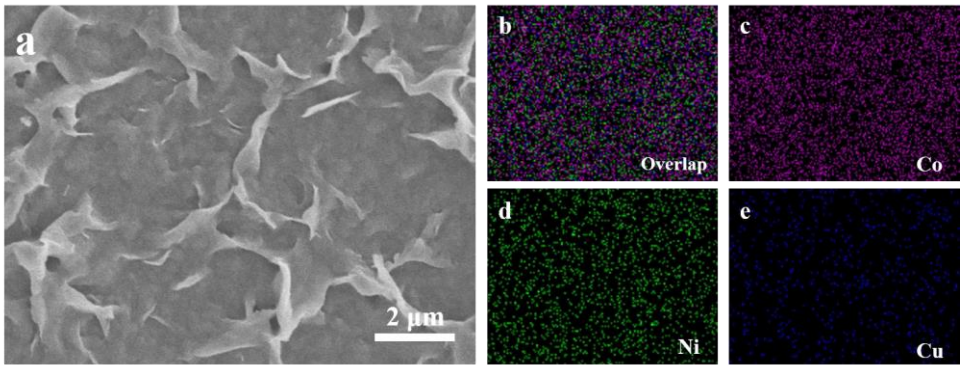

Fig. S2 (a-e) EDX elemental mapping images of CoNi-Cu(BDC).

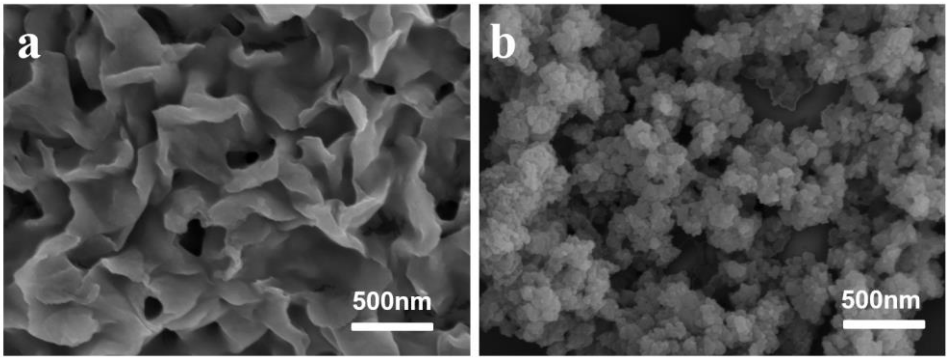

Fig. S3 (a) SEM images of Co-Cu(BDC) and Ni-Cu(BDC).

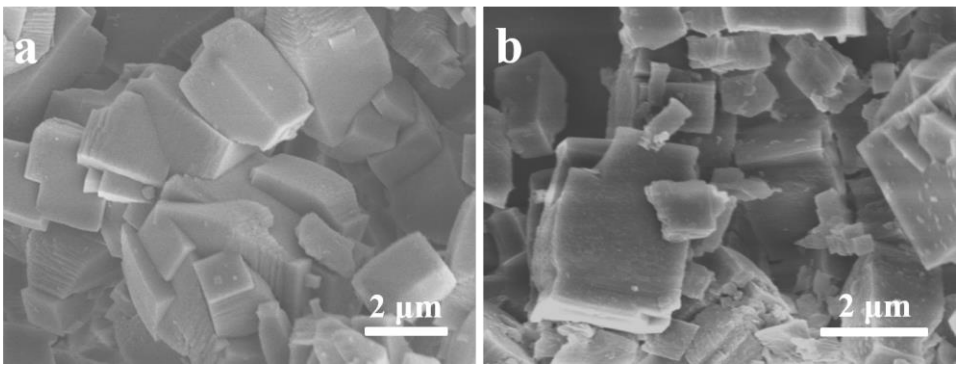

Fig. S4 SEM images of Cu(BDC) through hot reflux synthesis method before (a) and after impregnation (b).

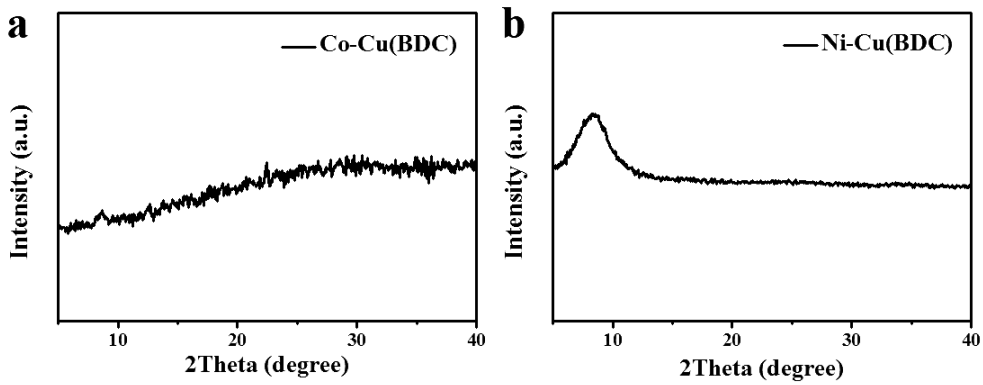

Fig. S5 (a) XRD patterns of Co-Cu(BDC) and Ni-Cu(BDC).

In order to seek the optimum conditions of CoNi-Cu(BDC) synthesis, numerous experiments need to be investigated. First, for the research of metal precursors, the ratio of Co and Ni is 1:1 and impregnation time is 60 min, changing the different metal precursors. Second, for the research of metal ions ratios, the metal precursors (cobalt acetate and nickel acetate) and impregnation time (60 min) are kept constant and the metal ions ratios are changed. Third, for the research of impregnation time, the metal precursors (cobalt acetate and nickel acetate) and ratios of Co/Ni (2:1) are

kept constant and the impregnation times are changed to 10 min, 30 min, 120 min and 240 min.

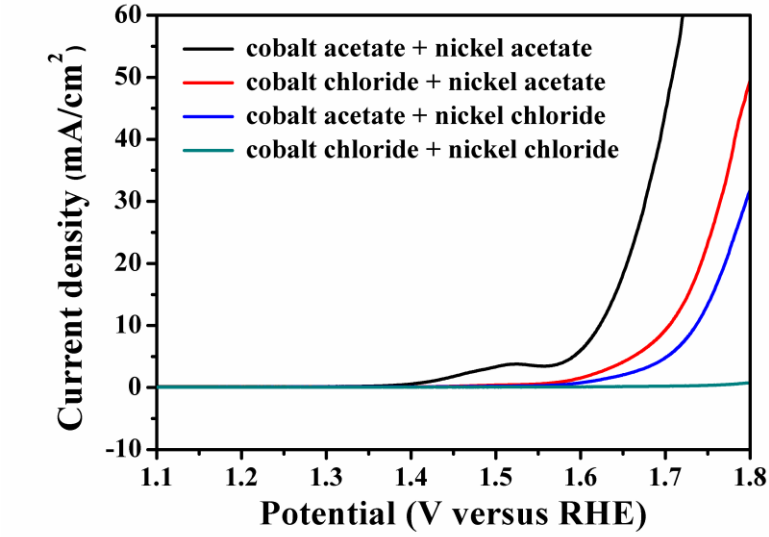

Fig. S6 LSV curves of CoNi-Cu(BDC) with different Co and Ni precursors.

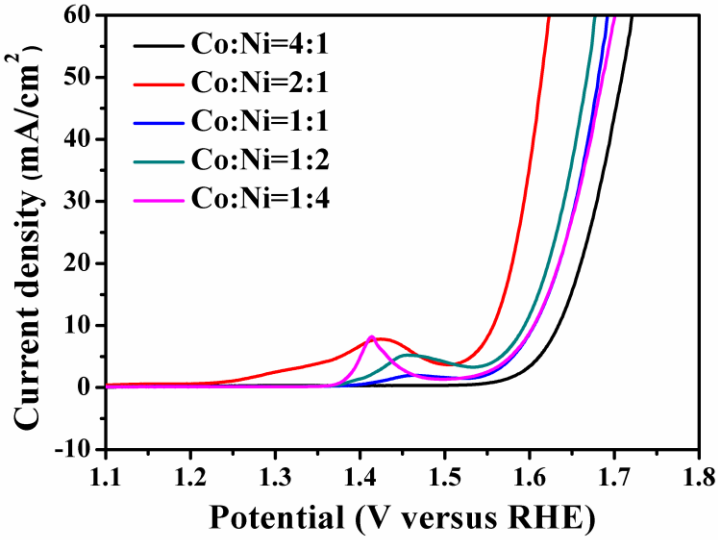

Fig. S7 LSV curves of CoNi-Cu(BDC) with different Co and Ni ratios.

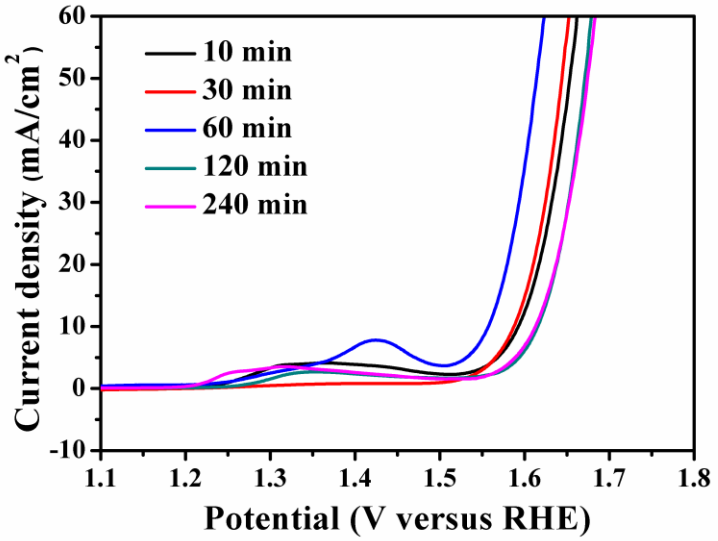

Fig. S8 LSV curves of CoNi-Cu(BDC) with different impregnation times.

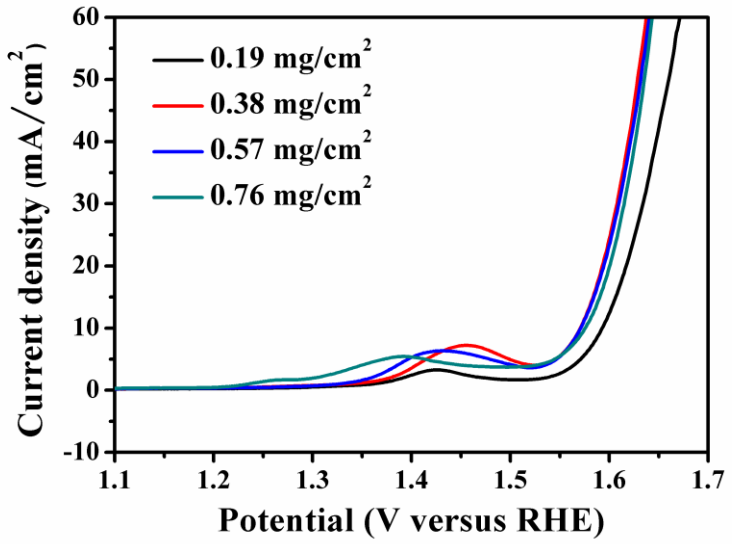

Fig. S9 LSV curves of CoNi-Cu(BDC) with different loading amounts.

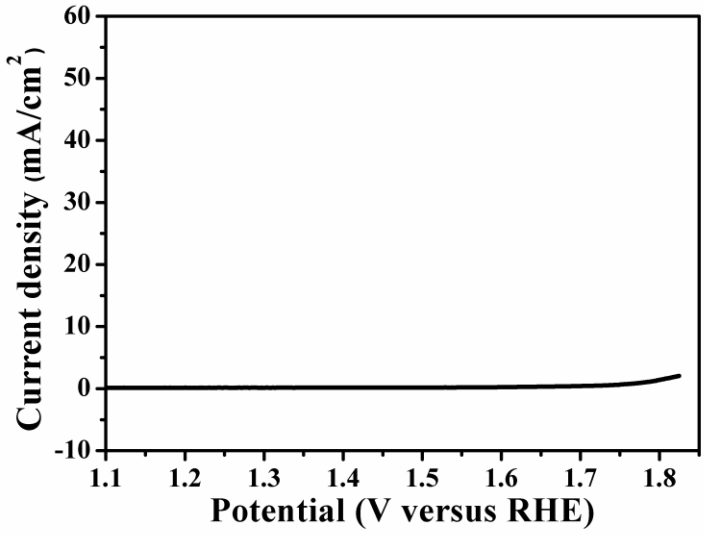

Fig. S10 LSV curve of CoNi-Cu(BDC) (Cu(BDC) through hot reflux synthesis method).

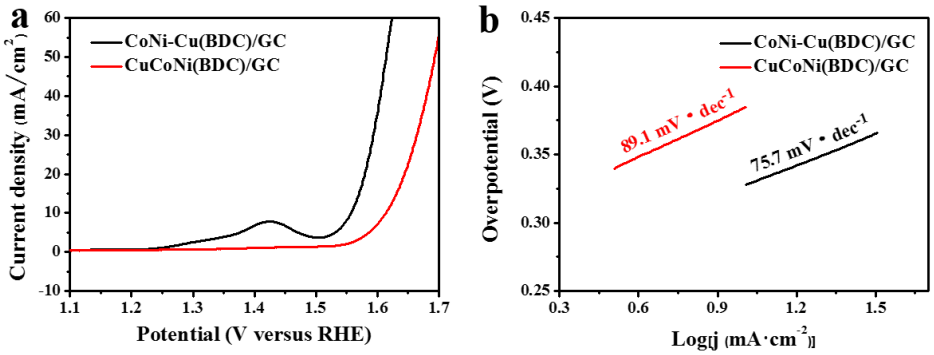

Fig. S11 (a) LSV curves and (b) Tafel plots of CoNi-Cu(BDC) and CuCoNi(BDC).

Table S1 The OER catalytic performances comparison of the recently reported MOF-based electrocatalysts.

Catalyst	Overpotential (mV)	Tafel slope (mV dec^{-1})	Electrolyte	Reference
CoNi-Cu(BDC)	327 mV @ 10 mA·cm^{-2}	75.7	1 M KOH	This work
CoNi-NDC/PANI-NF	323 mV @ 10 mA·cm^{-2}	73.3	1 M KOH	1
Co_3O_4/Fe_2O_3 nanocubes	310 mV @ 10 mA·cm^{-2}	67	1 M KOH	2
NiCo-C-3	420 mV @ 10 mA·cm^{-2}	107	1 M KOH	3
NiCoS-3	320 mV @ 10 mA·cm^{-2}	58.8	1 M KOH	4
CoNC-CNF-1000	450 mV @ 10 mA·cm^{-2}	94	0.1 M KOH	5
Co_9S_8/NSCNFs-850	302mV @ 30 mA·cm^{-2}	54	1 M KOH	6
Ni@NiO/N-C nanowires	390 mV @ 10 mA·cm^{-2}	100	1 M KOH	7
Co-Ni_3C/Ni@C	325 mV @ 10 mA·cm^{-2}	67.76	1 M KOH	8
FeNi@CNF	356 mV @ 10 mA·cm^{-2}	62.6	1 M KOH	9
Cu@CuO–C	340 mV @ 10 mA·cm^{-2}	156	0.1 M KOH	10

References:

1. W. J. Dang, Y. Q. Shen, M. Lin, H. Jiao, L. Xu and Z. L. Wang, *J. Alloys Compd.*, 2019, **792**, 69-76.
2. X. J. Wei, Y. H. Li, H. R. Peng, D. Gao, Y. Q. Ou, Y. B. Yang, J. R. Hu, Y. H. Zhang and P. Xiao, *Chem. Eng. J.*, 2019, **355**, 336-340.
3. A. Jayakumar, R. P. Antony, J. Zhao and J. M. Lee, *Electrochim. Acta*, 2018, **265**, 336-347.
4. Z. Yu, Y. Bai, S. M. Zhang, Y. X. Liu, N. Q. Zhang and K. N. Sun, *Int. J. Hydrogen Energy*, 2018,

43, 8815-8823.

5. W. M. Zhang, X. Y. Yao, S. N. Zhou, X. W. Li, L. Li, Z. Yu and L. Gu, *Small*, 2018, **14**, 8.
6. L. L. Wu, Q. S. Wang, J. Li, Y. Long, Y. Liu, S. Y. Song and H. J. Zhang, *Small*, 2018, **14**, 9.
7. A. J. Xie, J. Zhang, X. Tao, J. H. Zhang, B. Y. Wei, W. H. Peng, Y. W. Tao and S. P. Luo, *Electrochim. Acta*, 2019, **324**, 10.
8. X. X. Jia, M. H. Wang, G. Liu, Y. Wang, J. F. Yang and J. P. Li, *Int. J. Hydrogen Energy*, 2019, **44**, 24572-24579.
9. Y. W. Li, M. T. Lu, P. P. He, Y. H. Wu, J. W. Wang, D. N. Chen, H. Xu, J. K. Gao and J. M. Yao, *Chem.-Asian J.*, 2019, **14**, 1590-1594.
10. J. X. Wu, C. T. He, G. R. Li and J. P. Zhang, *J. Mater. Chem. A*, 2018, **6**, 19176-19181.