Supplementary Information

Ternary transition metal Co-Fe-Ni Sulfide as a High-Performance Anode for Microbial Fuel Cells

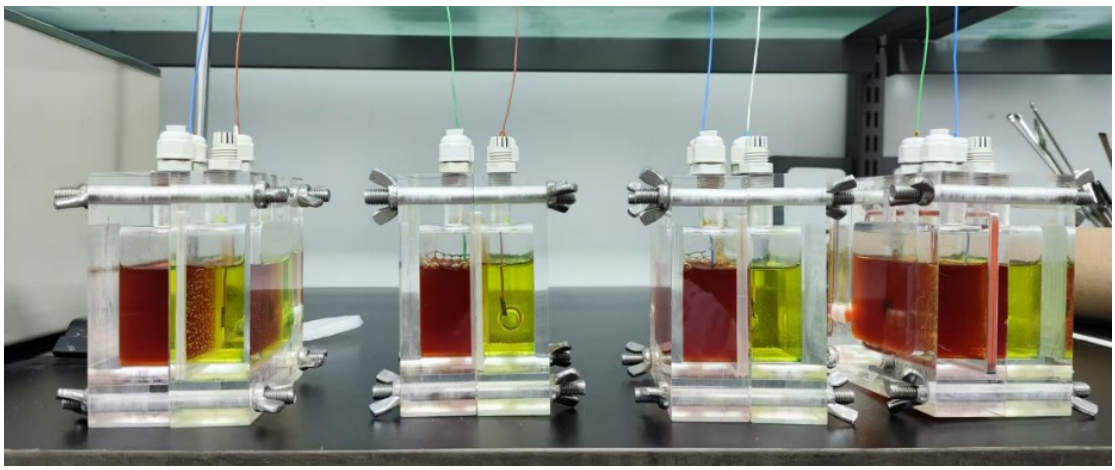
Qilin Guo[a,c], Jianchun Ma[d], Wenbo Lu[a,c], Ying Wang[a,c], Ergui Luo[a,c], He Xiao[a,c], Li Zhang[a,c], Haishun Wu [a,c]*, Tianjun Hu[a,b,c]*, Jianfeng Jia[a,b,c]*[1]

[a] School of Chemistry and Chemical Engineering of Shanxi Normal University, Taiyuan 030031, China

[b] Shanxi University of Electronic Science and Technology, Linfen 041000, China

[c] Shanxi Center of Technology Innovation for Advanced Power Battery Material, Shanxi Normal University, Taiyuan, 030031, China

[d] Department of Chemistry and Chemical Engineering, Lvliang University, Lishi 033001, China



*Corresponding authors.

E-mail: hutj@ sxnu.edu.cn (T.-J Hu), jiajf@dns.sxnu.edu.cn (J.-F Jia)

Fig. S1. Digital photo of the dual-chamber MFCs used in the experiments.

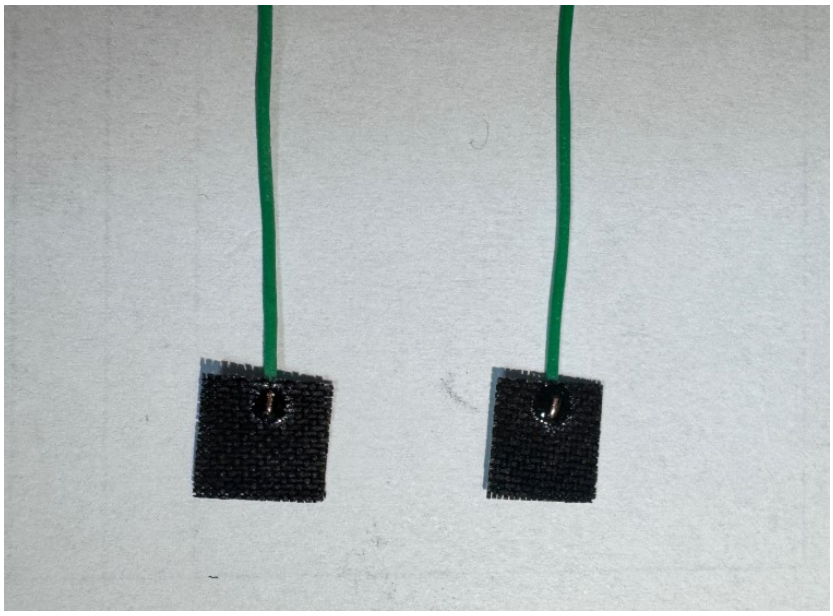


Fig. S2. Digital photo of the anode.

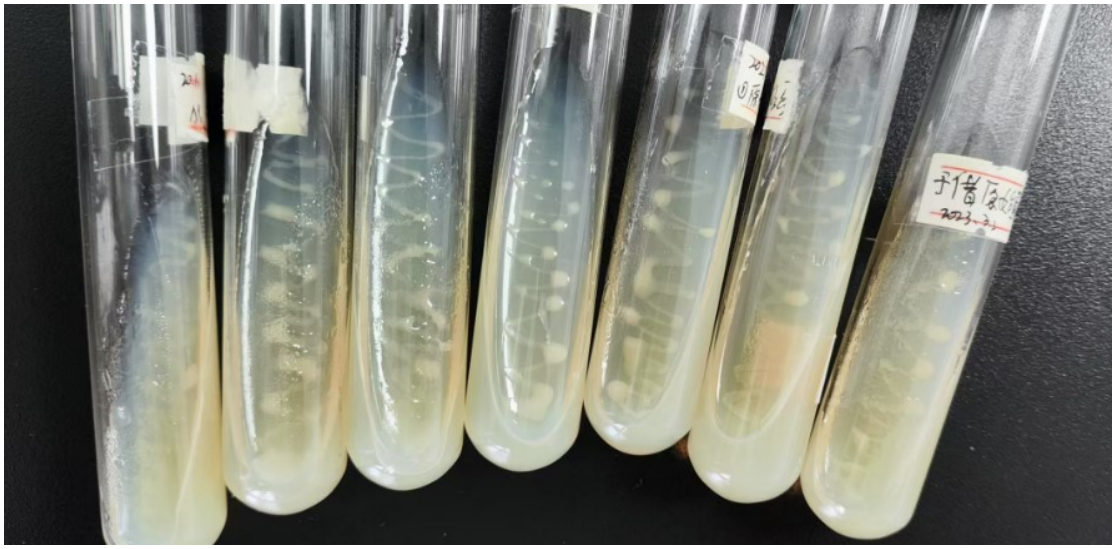


Fig. S3. Electronic image of *E. coli* on a solid medium.

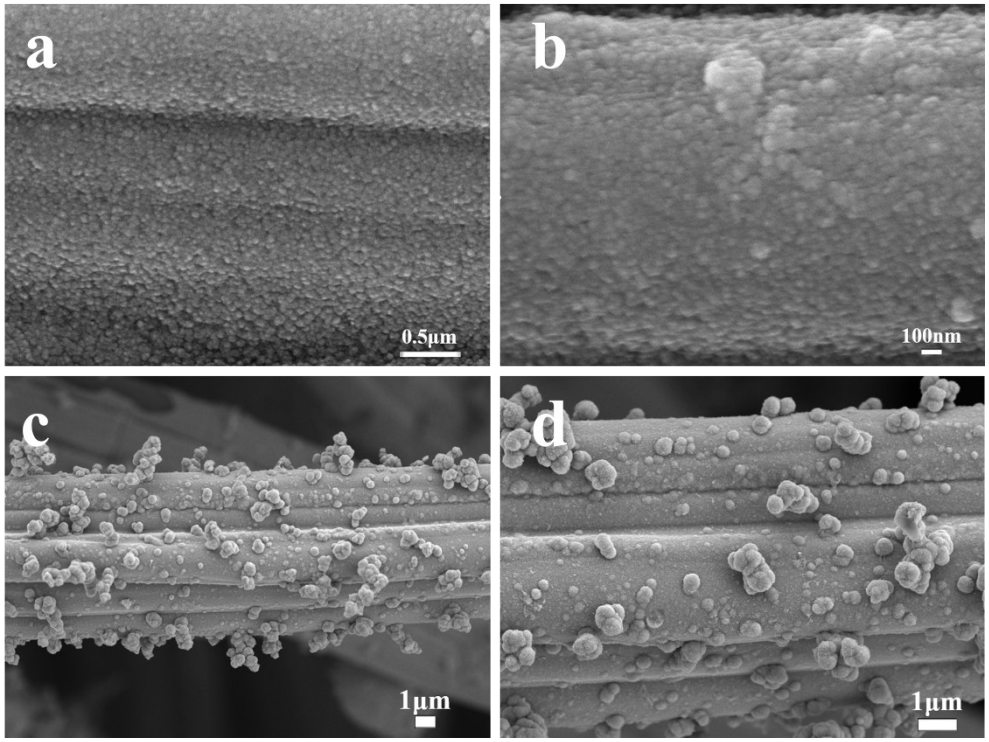


Fig. S4. (a) and (b) The SEM images of CoS. (c) and (d) The SEM images of Co-Fe-Ni.

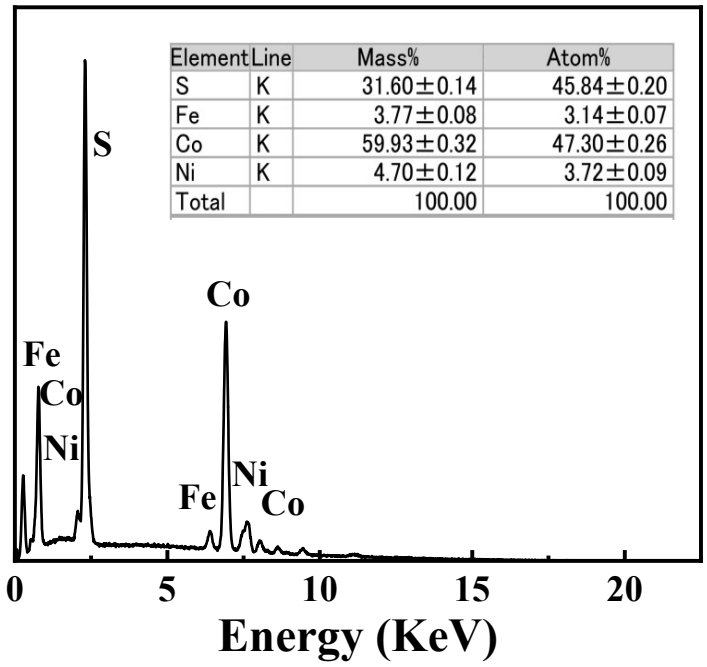


Fig. S5 SEM-EDS mappings of Co-Fe-Ni.

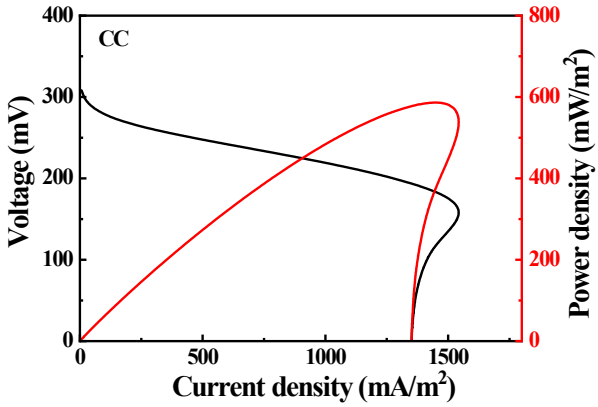


Fig. S6 The power density curves for MFCs equipped with of CC anodes with HNQ.

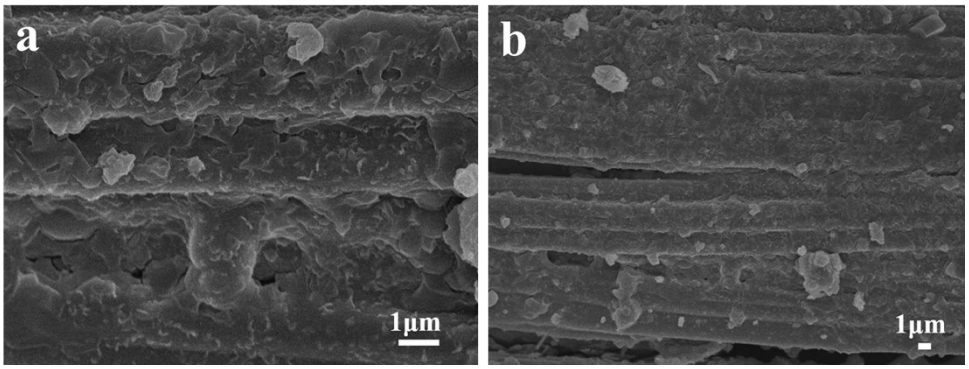


Fig. S7 (a) and (b) SEM image of the Co-Fe-Ni anode after repeated operation.

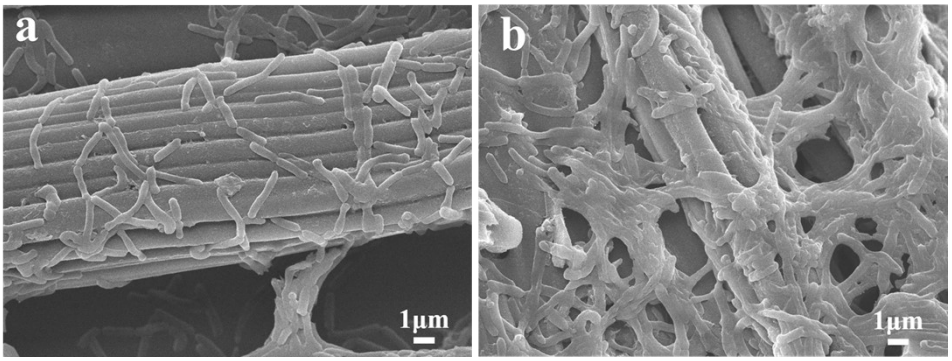


Fig. S8 SEM images of *E. coli* biofilm morphology on the anode: (a) Co-Fe, (b) Co-Fe-Ni.

Table S1 The fitting results obtained from CV results.

Anode	Double·Layer Capacitance· C_{dl} (mF cm^2)	Electrochemical·Active Surface·Area· ECSA (cm^2)
Co-Ni-Fe (4:1:1)	6.37	159.2
Co-Fe	5.30	132.5
CoS	5.4	135
CC	1.06	26.5

Table S2 The fitting results obtained from EIS results.

Anode	**Rs/Ω cm^2**	**Rct/Ω cm^2**	**CPE1T**
Co-Ni-Fe (4:1:025)	20.53	3.67	$5.7*10^{-4}$
Co-Ni-Fe (4:1:05)	22.02	4.12	$9.3*10^{-4}$
Co-Ni-Fe (4:1:1)	25.58	1.91	$1.1*10^{-4}$
Co-Ni-Fe (4:1:2)	29.4	5.98	$3.3*10^{-3}$
Co-Ni-Fe (4:1:4)	18.33	6.25	$1.1*10^{-3}$

Table S3 The distribution of different valence states of the element within the anode material.

	Co (%)	Co^{2+} (%)	Co^{3+} (%)	Fe (%)	Fe^{2+} (%)	Fe^{3+} (%)
Co-Fe	35.27	39.15	25.58	1.53	41.32	57.15
Co-Fe-Ni	30.37	48.98	20.65	1.33	48.55	51.12

Table S4 The comparison between the MFCs performance in this study and recent reports that utilized E. coli and other microorganisms as the biocatalysts.

Anode materials	**Bacteria**	**Power density ($mW m^2$)**	**Feed**	**Mediator Type**	**Concentration**	**Configure**	**Ref.**
porous graphite	*E.coli*	2600	glucose	NMP	/	single	1
rGO/NCNFs@Fe/Fe_3C	*E.coli*	2318	Vitamin	CH_3COONa	1g/L	two	2

			solution				
PVA	*E.coli*	1631	glucose	NMP	/	single	3
PANI/TiO_2	*E.coli*	1495	glucose	HNQ	5 mM	single	4
Porous carbon	*E.coli*	1606	glucose	/	/	two	5
carbon nanotubes	*E.coli*	3800	glucose	NMP	/	single	6
graphene	*E.coli*	2668	sucrose	HNQ	5 mM	two	7
Fe_2O_3-$CoFe_2O_4$	*E.coli*	3690	glucose	HNQ	5 mM	two	8
SC-FeNi	*Sludge*	1236	urine	/	/	two	9
Fe_1Co_1@CC	*Geobacter*	3220	organic solution	/	/	two	10
FeSNC-3	*Sludge*	2126	sewage	/	/	single	11
FeCo/Co/Co_2P/NPGC	*Sludge*	997	glucose	/	/	single	12
Co-Fe	*E.coli*	3611	glucose	HNQ	5 mM	two	This work
Co-Fe-Ni_4	*E.coli*	3915	glucose	HNQ	5 mM	two	This work

References

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