Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supplementary Information

A non-metallic copolymer material-based universal bio-abiotic hybrid platform boosting efficient electronic collection of microbial fuel cells

Rongyao Dong,[a] Zhijun Chen,*[a]

[a] State Key Laboratory of Supramolecular Structure and Materials, Institute of Theoretical Chemistry, College of Chemistry, Jilin University, 2699 Qianjin Street, 130012, Changchun, P. R. China.

*Corresponding authors: zchen@jlu.edu.cn

Table S1. The power density reported in previous years compared with this experiment of MFC equipped with S. oneidensis MR-1.

Anode material	Bacteria	Fuel	Single chamber volume (mL)	Pmax ($mW \cdot m^{-2}$)	Ref
graphite felt	Shewanella oneidensis MR-1	lactate	25	1326	1
graphite plate	Shewanella oneidensis MR-1	lactate and fumarate	200	150	2
PPy nanotubes	Shewanella oneidensis MR-1	LB broth and lactate	100	612	3
carbon fibers brush	Shewanella oneidensis MR-1	lactate	325	858 ± 9	4
3D rGO-hybrid biofilm /carbon cloth	Shewanella oneidensis MR-1	LB broth and lactate	50	843 ± 31	5
Carbon cloth	Shewanella oneidensis MR-1	lactate	50	233.0 ± 24.9	6
graphite felt	Shewanella oneidensis MR-1	Lactate/ acetate	120	578	2
carbon felt	Shewanella oneidensis MR-1	acetate	50	2520.2	3
graphitic carbon	Shewanella oneidensis MR-1	acetate	NA	750 ± 18	4
carbon felt	Shewanella putrefaciens	lactate	50	4400 ± 170	5
carbon nanofiber	Shewanella putrefaciens CN32	lactate	100	1747	6
poly-pyrrole paper-like membrane	Shewanella oneidensis MR-1	LB/lactate	100	612	7

carbon cloth	Shewanella oneidensis MR-1	lactate	50	2630 ± 202	8
GO/MWCNTs/Fe_3O_4 Foams	Shewanella oneidensis MR-1	lactate	50	1711	9
carbon felt	Shewanella oneidensis MR-1	lactate	30	3210	10
graphite felt	Shewanella oneidensis MR-1	acetate	25	7018 ± 352	this study

Table S2 The fitted Chi-Squared values of AC Impedance.

Types	Chi-Squared
GF	0.00068421
Lq-GF	0.0090974
Pr-GF	0.00038023
LqPr-GF	0.0012188

Video 1 The contact angle experiment of pure graphite felt (GF) materials (without modification).

Video 2 The contact angle experiment of P1-PPy-GF materials (with co-polymer modification).

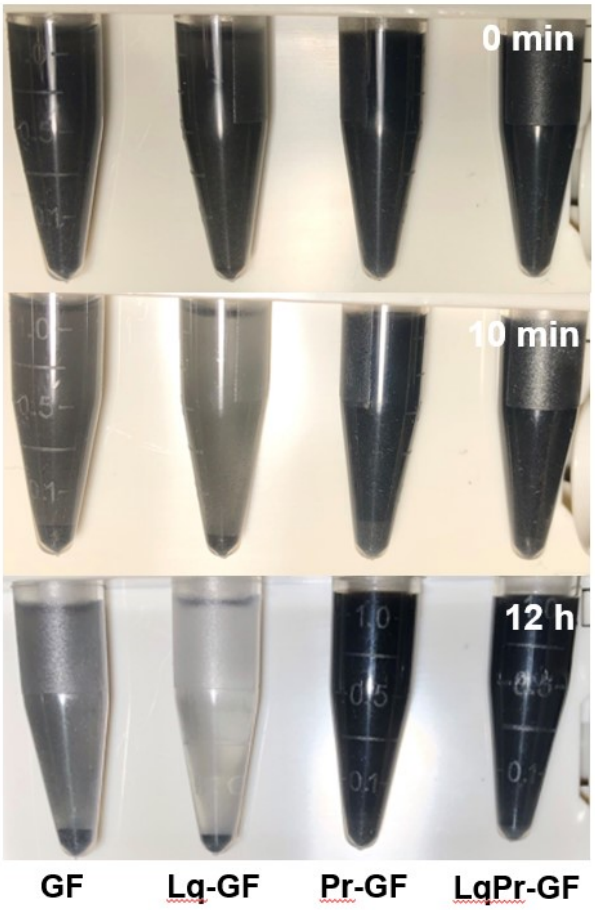

Figure S1 The dispersibility of GF, Lq-GF, Pr-GF, LqPr-GF modified electrode materials the in aqueous solution after lapping.

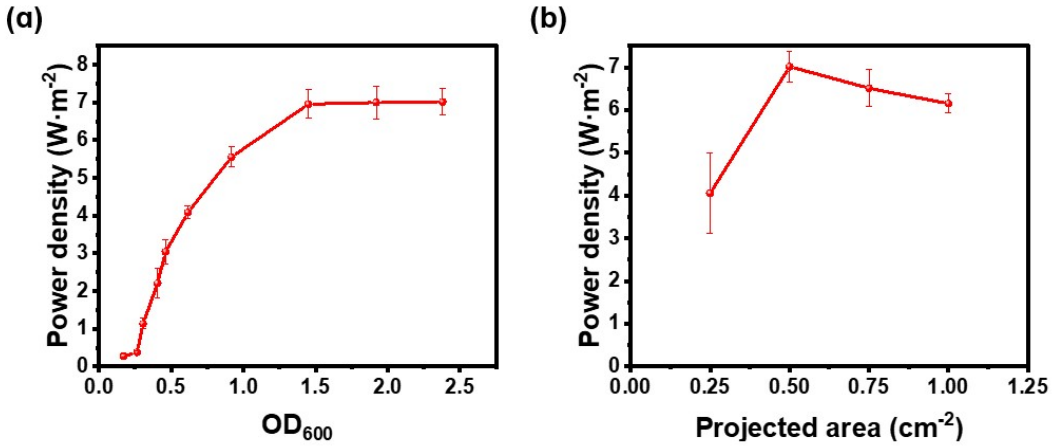

Figure S2 The change of power density following the increase of cell density (a) or cross sectional area of graphite felt (b).

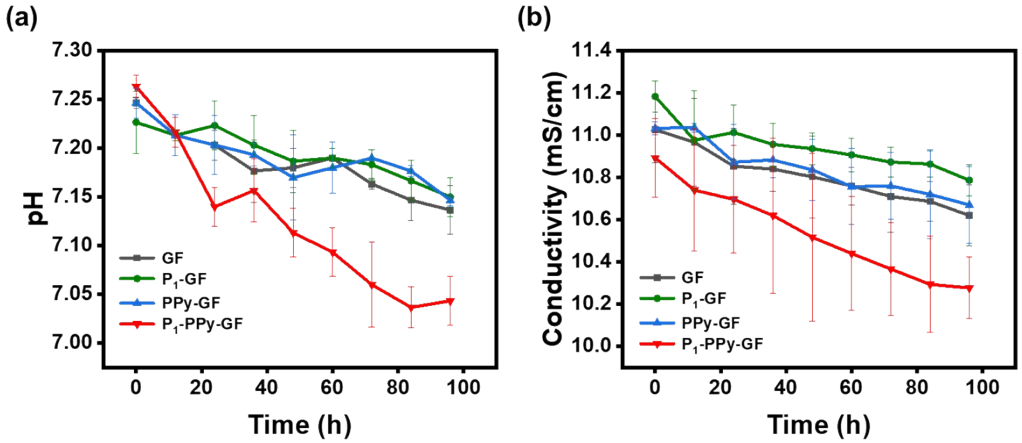

Figure S3 The change of the pH (a) and conductivity (b) of the electrolytes in the MFC anode chamber with the reaction time.

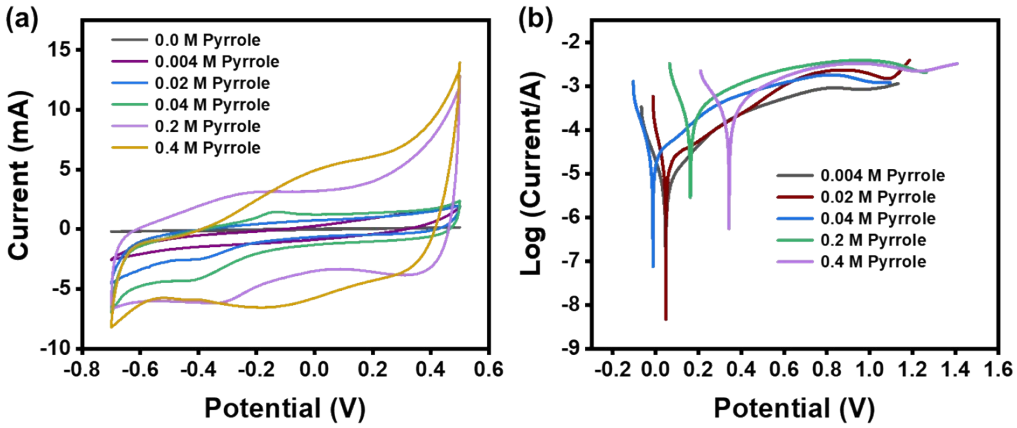

Figure S4 The electron transfer rate on the surface of a material following the change of the content of pyrrole on the surface of the materials. (a) Cyclic voltammogram. (b) Tafel curves.

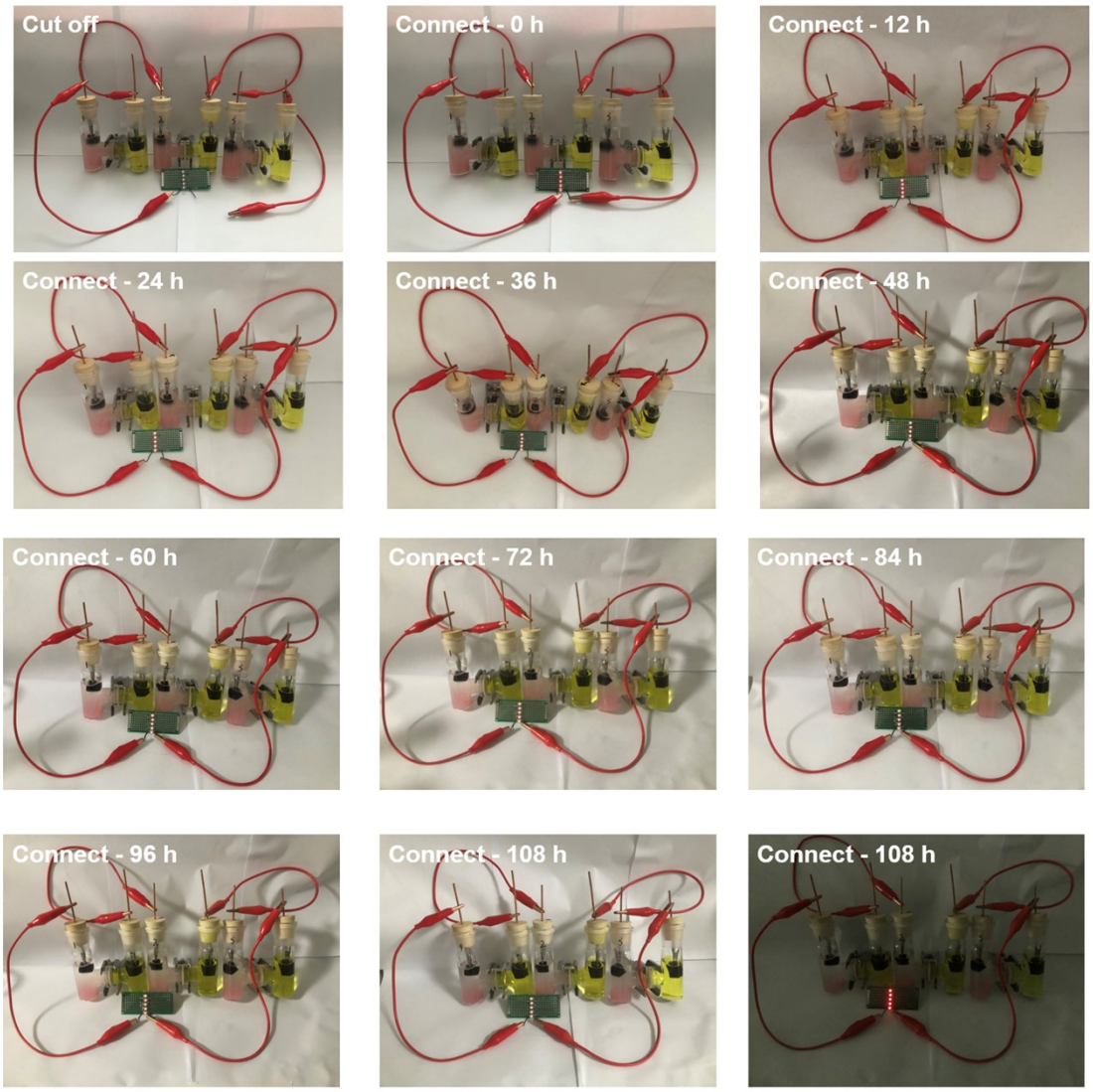

Figure S5 The proposed MFCs connected in series serve as supply unit to light up the LED miniature lamps, which can work for a long time.

References

1 W. Zeng, X. Wu, T. Chen, S. Sun, Z. Shi, J. Liu, X. Ji, X. Zeng, J. Guan, L. Mei and M. Wu, *Adv. Funct.,* 2021, 31, 2008362-2008372.

2 S. B. Velasquez-Orta, I. M. Head, T. P. Curtis, K. Scott, J. R. Lloyd, H. Canstein, *Appl. Microbiol. Biotechnol.,* 2010, **85**, 1373–1381.

3 C. Zhao, J. Wu, S. Kjelleberg, J. S. C. Loo, Q. Zhang, *Small,* 2015, **11**, 3440–3443.

4 V. J. Watson, B. E. Logan, *Biotechnology and Bioengineering,* 2010, **105**, 489-498.

5 Y. Yong, Y. Yu, X. Zhang, H. Song, *Angew. Chem. Int. Ed.,* 2014, **53**, 4480 –4483.

6 Y. Yang, Y. Ding, Y. Hu, B. Cao, S. A. Rice, S. Kjelleberg, H. Song, *ACS Synth. Biol.,* 2014, **4**, 815-823.

7 S. Yan, H. Song, Y. Li, J. Yang, X. Jia, S. Wang and X. Yang, *Appl. Catal. B.*, 2022, 301, 120820-120832.

8 D. Samanta, N. Hosseini-Nassab, A. D. McCarty and R. N. Zare, *Nanoscale*, 2018, **10**, 9773-9779.

9 Y. Jin, X. Yang and J. Tian, *Nanoscale*, 2018, **10**, 9594-9601.

10 C. Yang, H. Aslan, P. Zhang, S. Zhu, Y. Xiao, L. Chen, N. Khan, T. Boesen, Y. Wang, Y. Liu, L. Wang, Y. Sun, Y. Feng, F. Besenbacher, F. Zhao and M. Yu, *Nat. Commun.*, 2020, **11**, 1379-1389.

11 L. S. Yijia Xiong, Baowei Chen, M. Uljana Mayer, Brian H. Lower, Yuri Londer, Saumyaditya Bose, Michael F. Hochella, James K. Fredrickson, and Thomas C. Squier, *J. Am. Chem. Soc.*, 2006, **128**, 13978-13979.

12 S. Wang, F. Liu, C. Gao, T. Wan, L. Wang, L. Wang, L. Wang, *Chem. Eng. J.,* 2019, **370**, 322-329.

13 S. Fan, B. Liang, X. Xiao, L. Bai, X. Tang, E. Lojou, S. Cosnier and A. Liu, *J. Am. Chem. Soc.*, 2020, **142**, 3222-3230.

14 E.T. Sayed, M.A. Abdelkareem, H. Alawadhi, K. Elsaid, T. Wilberforce, A.G. Olabi, *Energy,* 2021, **221**, 119849-119857.

15 B. Liang, L. Han, *Biosens. Bioelectron.,* 2020, **148**, 111825-111831.