Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting information

Enhancing Li^+ transport via nano-porous cellulose membrane with anion-sorbent for high-performance lithium-ion batteries

Kang Ma[a b], Xin Song[a], Jian Wang[a], Jiawei Chen[a], Zongmin Zheng[a], and Jianmin Zhang[a*]

a.College of Mechanical and Electrical Engineering, National Engineering Research Center for Intelligent Electrical Vehicle Power System (Qingdao), Qingdao University, Qingdao, 266071, China

b.School of Materials Science and Engineering, Qingdao University, Qingdao 266071, China

*Corresponding author, E-mail: zhangjm@qdu.edu.cn (J. Zhang).

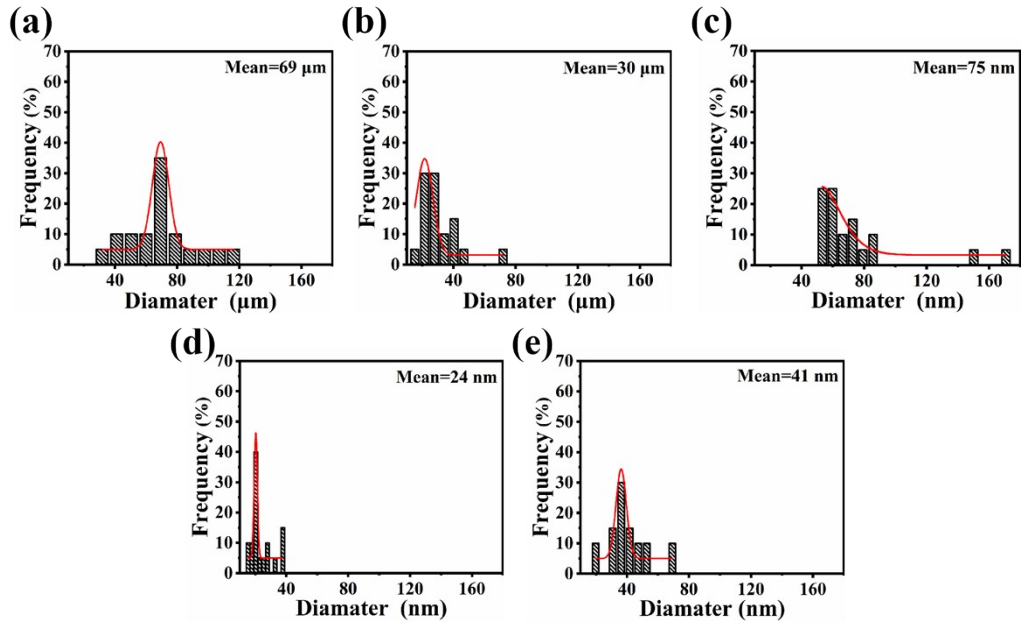

Figure S1. (a , b, c, and d) Pore size distributions of the CF, CF-0.4, CF-0.6, CF-0.8, and CF-0.6Z membranes.

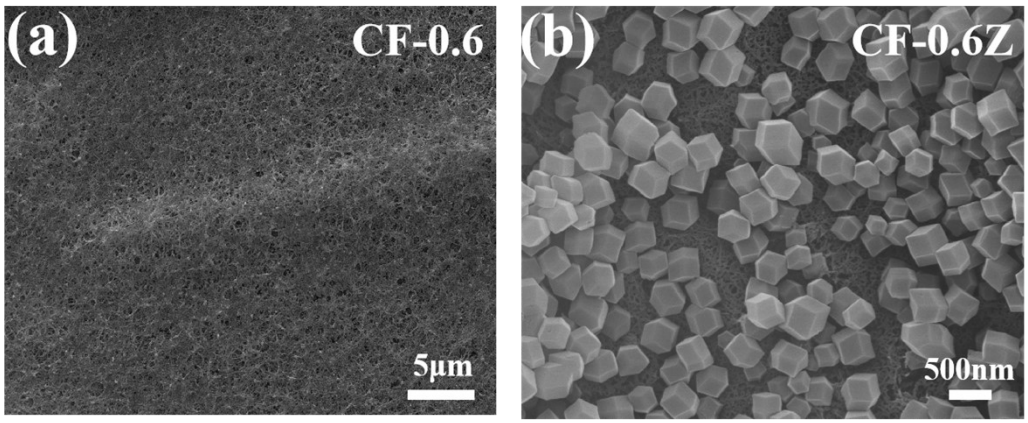

Figure S2. SEM images of (a) CF-0.6, (b) CF-0.6Z membranes.

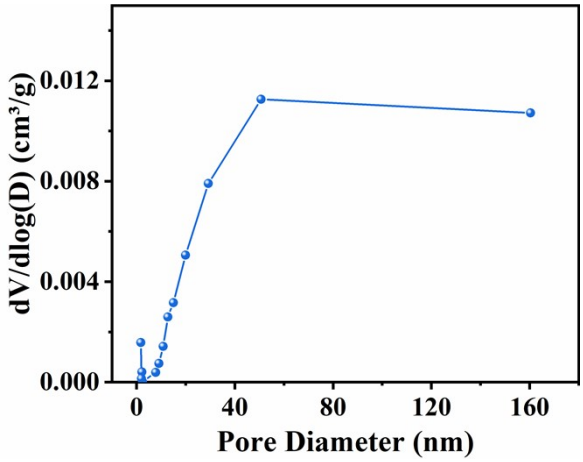

Figure S3. Pore size distribution of the CF-0.6 membrane.

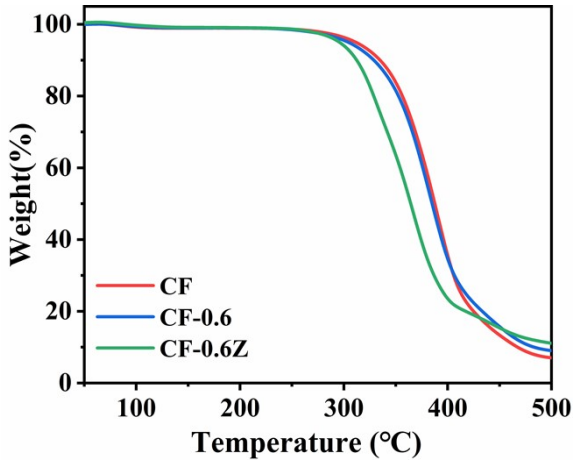

Figure S4. TG curves of different membranes.

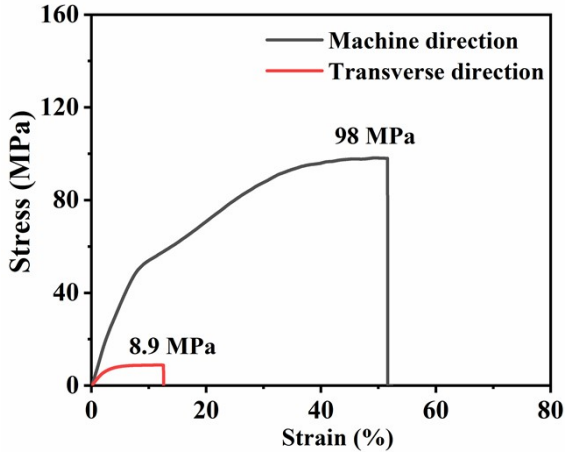

Figure S5. Stress-strain curves of the PP membrane.

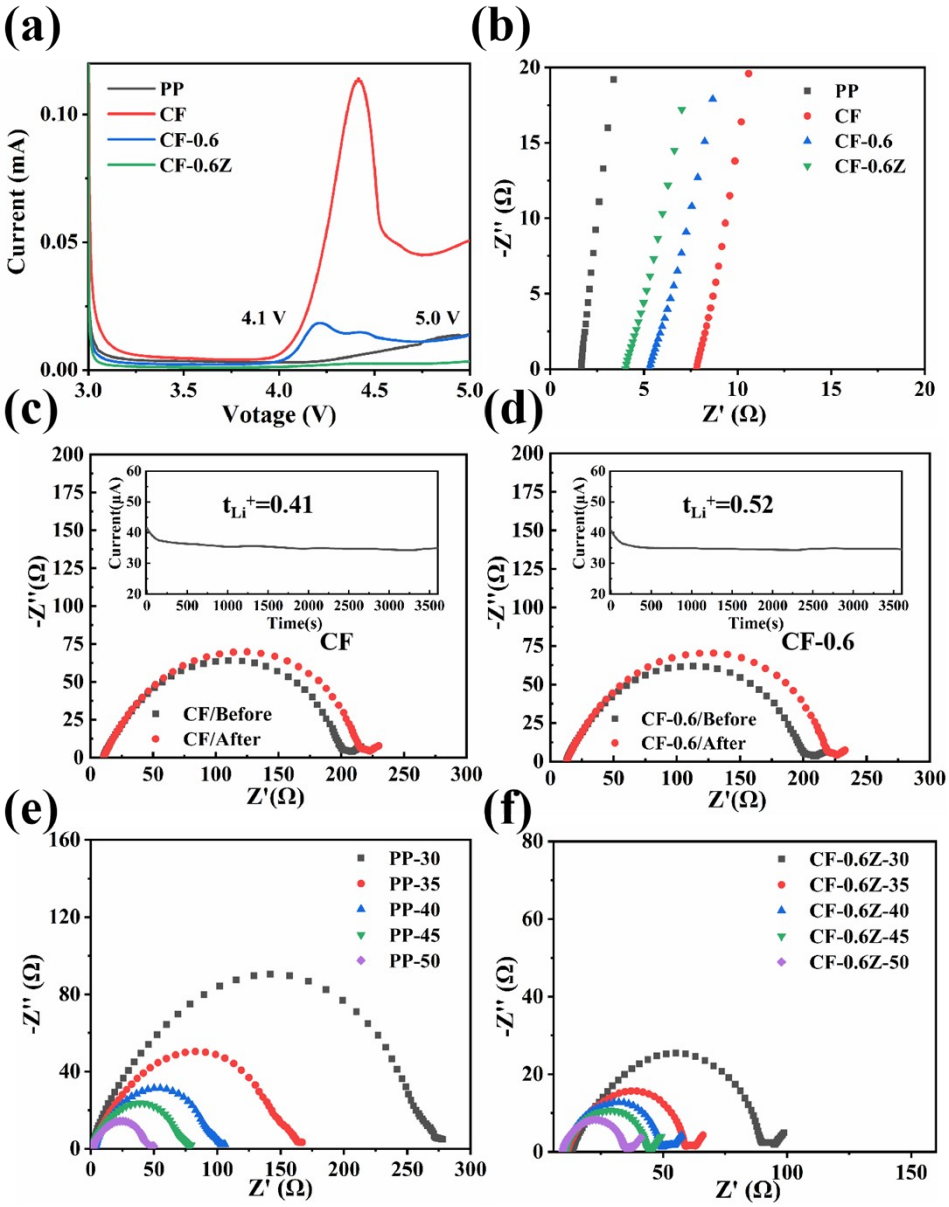

Figure S6. (a) LSV curves of SS/membrane/Li cells with different membranes; (b) Nyquist plots of SS/membrane/SS cells; Li^+ transference number with (c) CF and (d) CF-0.6 membranes; The charge transfer resistances (R_{ct}) at different temperatures of symmetric Li/Li cells with (e) PP and (f) CF-0.6Z membranes.

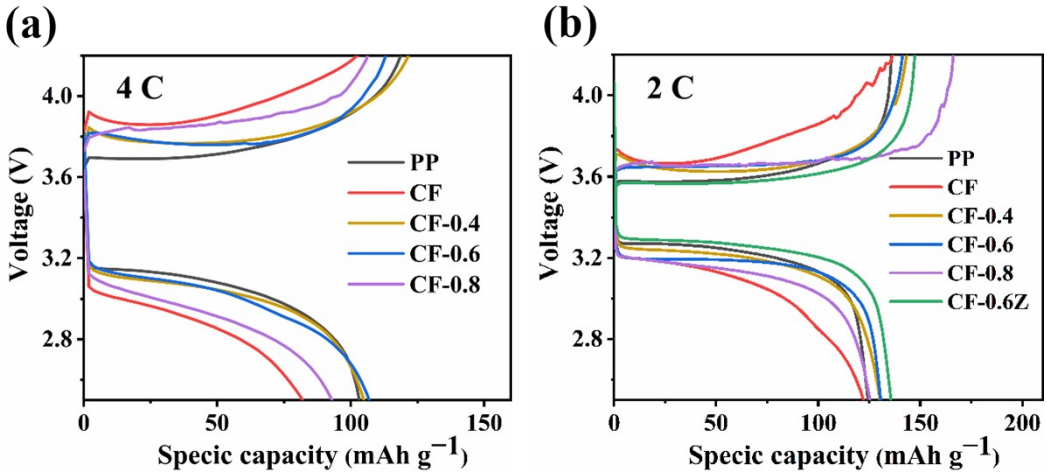

Figure S7. The charging-discharging profiles of cells with different membranes: (a) 4 C; (b) 2 C.

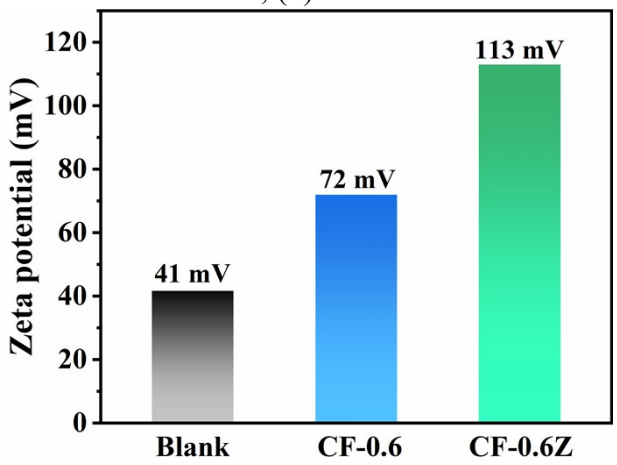

Figure S8. Zeta potential of electrolyte before and after 12 h immersion of the CF-0.6 and CF-0.6Z membranes.

Table S1. Resistance (R_b and R_{ct}) and ionic conductivity (σ) of symmetrical SS/membrane/SS cells with different membranes.

Sample	D (μm)	R_b (Ω)	σ (mS cm^{-1})	R_{ct} (Ω)
PP	25.0	1.7	0.74	230
CF	113.0	7.8	0.76	154
CF-0.6	110.0	5.3	1.1	124
CF-0.6Z	118.5	4.0	1.43	87

Table S2. The specific values for lithium ion transference number calculation.

Sample	I_0(μA)	I_s (μA)	R_0 (Ω)	R_s (Ω)	t_{Li^+}
PP	31.6	26.5	296	333	0.45
CF	44	34.5	196	213	0.41
CF-0.6	46	35	178	199.9	0.52
CF-0.6Z	72.8	60.1	108.7	116.2	0.57

Table S3. Performance comparison of cellulose-based composite membrane in $LiFePO_4$/membrane/Li cells.

Composite membrane	Electrolyte uptake (%)	σ ($mS \cdot cm^{-1}$)	Discharging Capacity ($mAh \cdot g^{-1}$)	Capacity retention rate (%/cycle number/C-rate)	Reference
Hydroxyapatite /CNF	162	0.81	2 C/100	81/100/0.5 C	[1]
ZIF-67@CNF	460	1.55	4 C/110	88.4/100/0.5 C	[2]
BC@ZIF-67	230	0.837	2 C/85	91/100/0.2 C	[3]
ZIF-8-CNF	—	1.41	4 C/100	88/100/0.5 C	[4]
ZIF-8@BC	340	1.12	3 C/105	89/100/0.5 C	[5]
Regenerated Cellulose Separator	425	1.05	2 C/129	81/100/0.5 C	[6]
CF-0.6Z	423	1.43	4 C/114	95/300/1.0 C	This work

References

1 Y. Liu, C. Li, C. Li, Z. Liang, X. Hu, H. Liu, Z. Zhang, M. Cui, G. Chen, J. Wan, X. Zhang and J. Tao, ACS Appl. Energy Mater, 2023, **6**, 3862-3871.

2 X. Sun, W. Xu, X. Zhang, T. Lei, S.-Y. Lee and Q. Wu, J. Energy Chem, 2021, **52**, 170-180.

3 Q. Huang, C. Zhao and X. Li, Cellulose, 2021, **28**, 3097-3112.

4 X. Sun, M. Li, S. Ren, T. Lei, S. Y. Lee, S. Lee and Q. Wu, J. Power Sources, 2020, **454**, 227878.

5 S. Zhang, J. Luo, M. Du, F. Zhang and X. He, Cellulose, 2022, **29**, 5163-5176.

6 Y. Wang, X. Liu, J. Sheng, H. Zhu and R. Yang, ACS Sustain. Chem. Eng, 2021, **9**, 14756-14765.