# Supporting Information

In-situ form graphitic $C_3N_4$-PDOL composite interlayer toward stable lithium metal anodes

Zilong Zhuang,[1,2] Yating Tang,[1] Bowei Ju,[1,*] Tete He[1], Feiyue Tu[1,*]

[1]Changsha Research Institute of Mining and Metallurgy, Changsha, 410012, China

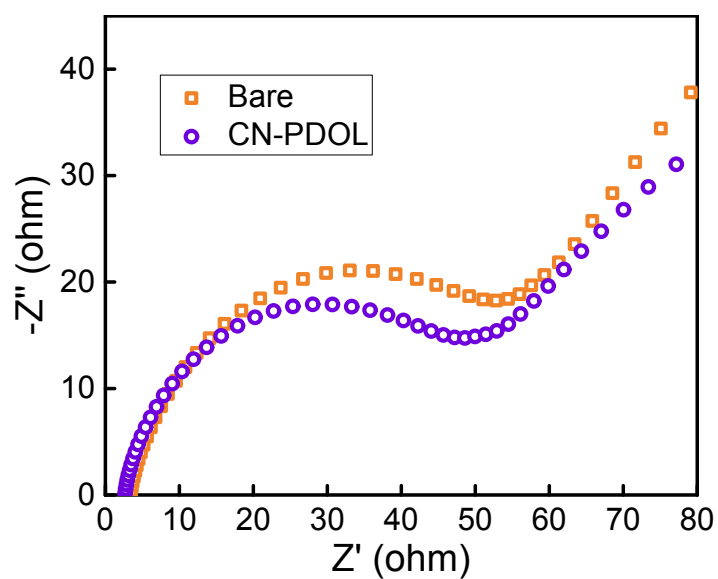[2]Department of Chemistry, Fudan University, Shanghai, 200082, China

Fig. S1 EIS spectra of NMC532|Bare-Li and NMC532|CN-PDOL-Li before cycling.
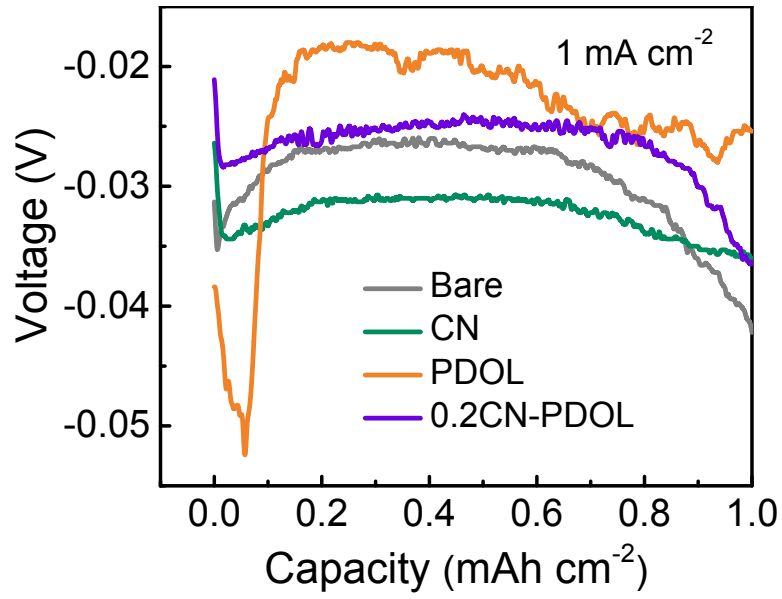
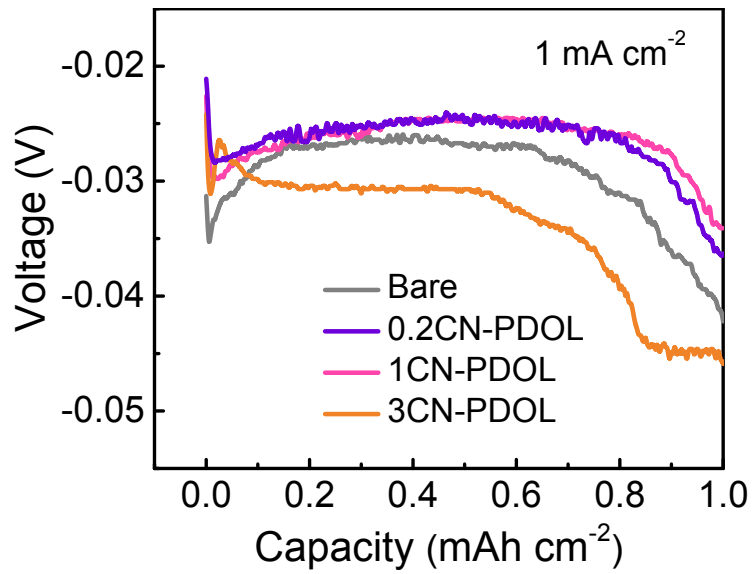Fig. S2 Voltage profiles during Li nucleation on different samples at 1 mA cm$^{-2}$ to 1 mAh cm$^{-2}$.



Fig. S3 Voltage profiles during Li nucleation on bare Li and CN-PDOL-Li at 1 mA cm$^{-2}$ to 1 mAh cm$^{-2}$.
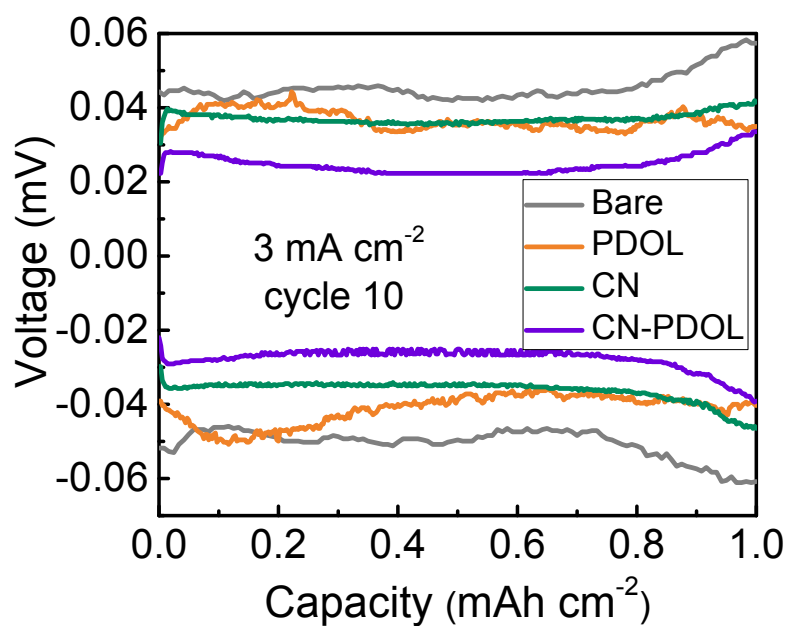
Fig. S4 Voltage profiles at 10th cycle of bare-Li, PDOL-Li, CN-Li, CN-PDOL-Li with a

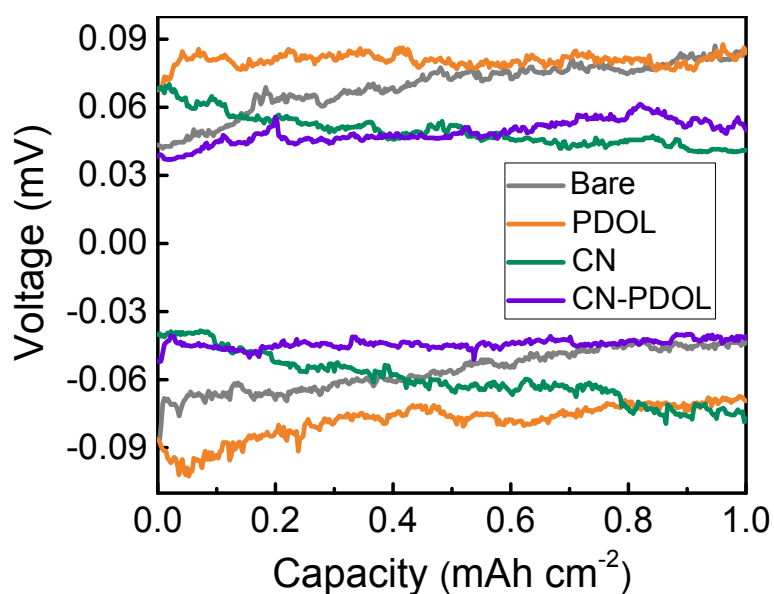cycling capacity of 3 mA cm$^{-2}$ to 1 mAh cm$^{-2}$.



Fig. S5 Voltage profiles of bare-Li, PDOL-Li, CN-Li, CN-PDOL-Li with a cycling capacity

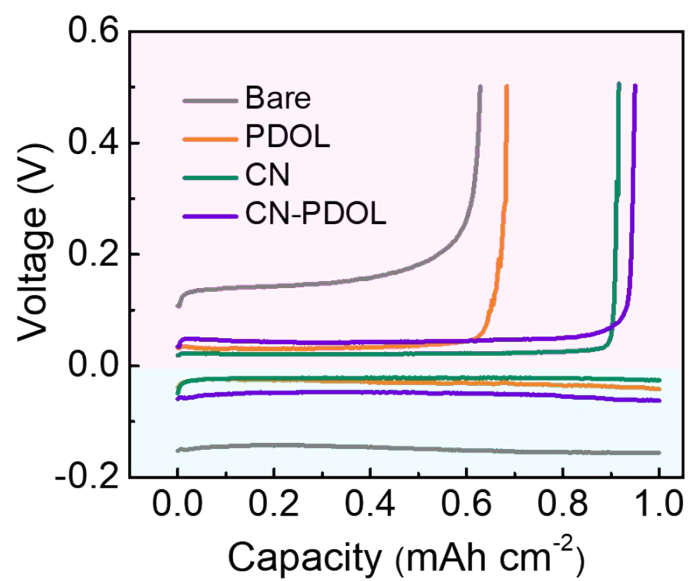of 3 mA cm$^{-2}$ for a total 1 mAh cm$^{-2}$ of Li at 200th cycle.

Fig. S6 charge-discharge profiles of Li-Cu cells with a cycling capacity of 1 mA cm$^{-2}$ for a total 1 mAh cm$^{-2}$ of Li at 40th cycle.
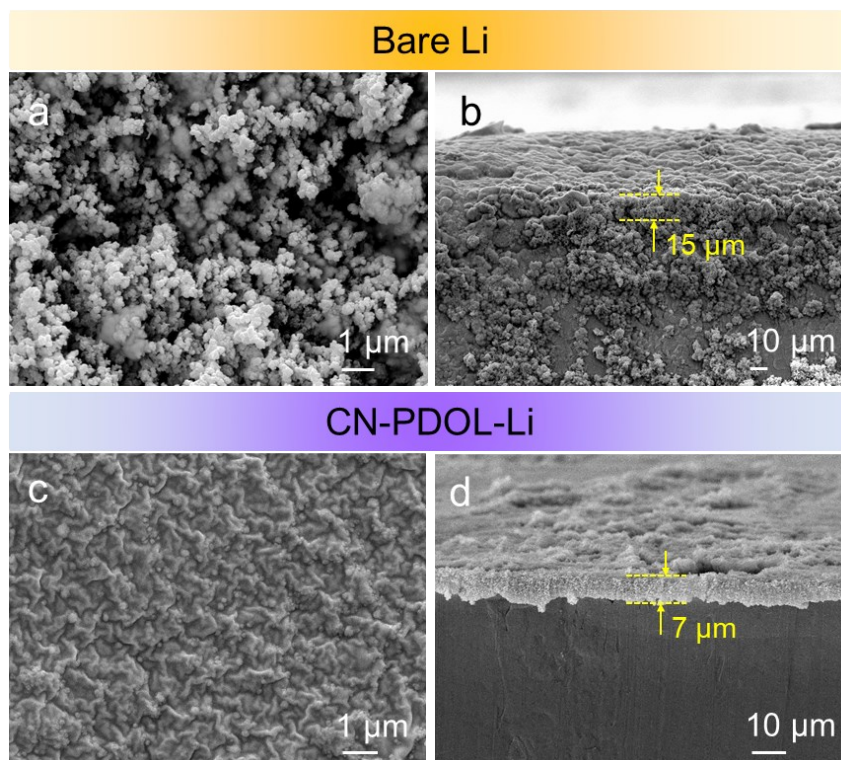
Fig. S7 SEM images of Li deposited on bare Li and CN-PDOL-Li of Li-Li symmetric cells after 10 cycles with a current density of 1 mA cm$^{-2}$ for a total 1 mAh cm$^{-2}$ of Li. (a) Top view and (b) cross-section of bare Li; (c) Top view and (d) cross-section of CN-PDOL-Li.

Table S1 The cycle performance comparison of reported Li symmetry cells and this work.

| Electrode | Cycle | Overpotential (mV) | Current density (mA cm$^{-2}$) | Capacity (mAh cm$^{-2}$) | Ref. |
|---|---|---|---|---|---|
| PDOL-Li | 200 | 50 | 1 | 1 | 1 |
| SR-G-Li | 400 | 50 | 5 | 1 | 2 |
| NPCC-Li | 240 | 100 | 5 | 1 | 3 |
| M-Li | 200 | 50 | 1 | 1 | 4 |
| Li$_x$Si-Li | 400 | ~120 | 1 | 1 | 5 |
| LDP-Li | 220 | ~20 | 1 | 1 | 6 |
| 3D L-G-Li | 80 | 200 | 5 | 1 | 7 |
| CN-PDOL-Li | 850 | 70 | 3 | 1 | This work |

## References

1    Q. Zhao, X. Liu, S. Stalin, K. Khan and L. A. Archer, *Nat. Energy*, 2019, **4**, 365-373.
2    M. Bai, K. Xie, K. Yuan, K. Zhang, N. Li, C. Shen, Y. Lai, R. Vajtai, P. Ajayan and B. Wei, *Adv. Mater.*, 2018, **30**, 1801213.
3    K. Li, Z. Hu, J. Ma, S. Chen, D. Mu and J. Zhang, *Adv. Mater.*, 2019, **31**, e1902399.
4    D. Wang, C. Luan, W. Zhang, X. Liu, L. Sun, Q. Liang, T. Qin, Z. Zhao, Y. Zhou, P. Wang and W. Zheng, *Adv. Energy Mater.*, 2018, **8**, 1800650.
5    W. Tang, X. Yin, S. Kang, Z. Chen, B. Tian, S. L. Teo, X. Wang, X. Chi, K. P. Loh, H. W. Lee and G. W. Zheng, *Adv. Mater.*, 2018, **30**, 1801745.
6    X. Shen, T. Qian, P. Chen, J. Liu, M. Wang and C. Yan, *ACS Appl. Mater. Interfaces*, 2018, **10**, 30058-30064.
7    W. Deng, X. Zhou, Q. Fang and Z. Liu, *Adv. Energy Mater.*, 2018, **8**, 1703152.