Surface-modified carbon nanotubes electrocatalysts for enhanced Lithium-Sulfur Battery performance

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Lithium-sulfur (Li-S) batteries, with a high theoretical energy density of 2600 Wh kg^{-1}, are promising for future energy storage [1]. However, the multiphase sulfur redox reaction remains challenging [2]. Herein, an organic framework-based electrocatalytic polymer composite, incorporating zinc(II) 5,10,15,20-tetrakis-(2,2'-bithien-5-yl)porphyrin (Zn-Por) into polybisthiophene (PBTH) linkers on carbon nanotube (CNT) surfaces, enhances redox kinetics. ZnPor-PBTH/CNTs was characterized by SEM, EDAX, XPS, and FTIR. In Li-S coin cells, electrochemical studies (CV, EIS, GCPL) showed a discharge capacity of 1144.14 mAh g^{-1} at C/20, low resistance (20 Ω), and stable cycling up to 50 cycles at C/10 with reduced polarization and suppressed polysulfide shuttling.

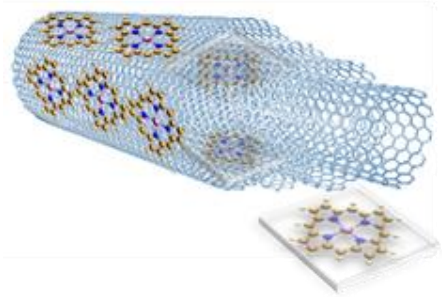

Figure 1. Carbon nanotubes functionalized with Zn-Por sites linked by PBTH.

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References

[1] B.Q. Li, H.J. Peng, X. Chen, S.Y. Zhang, J. Xie, C.X. Zhao, and Q. Zhang, *CCS Chem*istry **1**, 128 (2019).
[2] C.X. Zhao, X.Y. Li, M. Zhao, Z.X. Chen, Y.W. Song, W.J. Chen, J.N. Liu, B. Wang, X.Q. Zhang, C.M. Chen, B.Q. Li, *JACS* **143**, 865 (2021).