Supporting Information

# Accelerated Polysulfide Conversion on Hierarchical Porous Vanadium-Nitrogen-Carbon for Advanced Lithium-Sulfur Batteries

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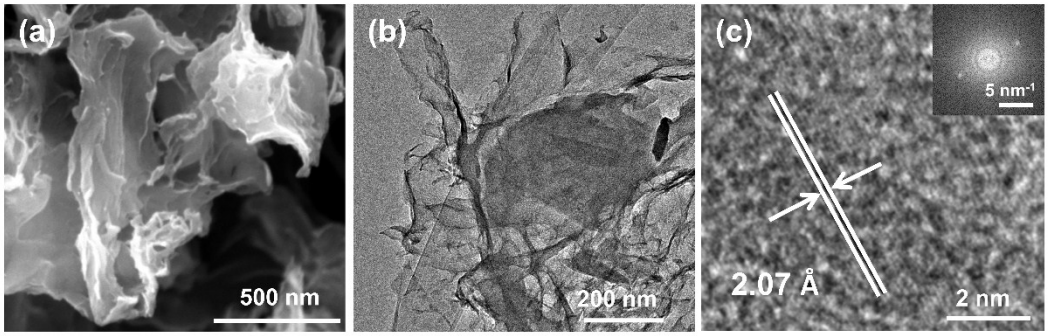


**Fig. S1.** (a) SEM, (b) TEM, (c) High-resolution TEM images (the inset shows its corresponding FFT image of VN/N-C.

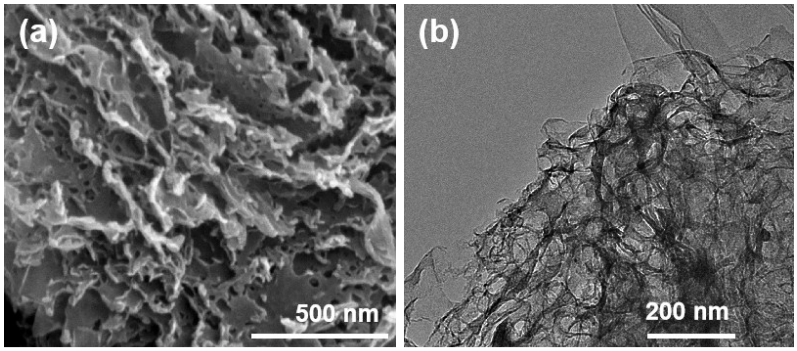


**Fig. S2**. (a) SEM and (b) TEM images of N-C.

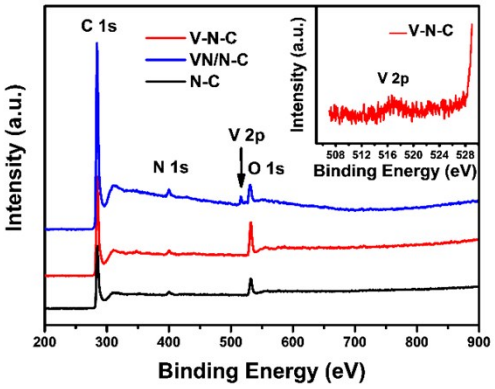


**Fig. S3.** XPS survey spectra of V-N-C, VN/N-C and N-C samples (inset: magnified XPS survey scan for V of V-N-C).

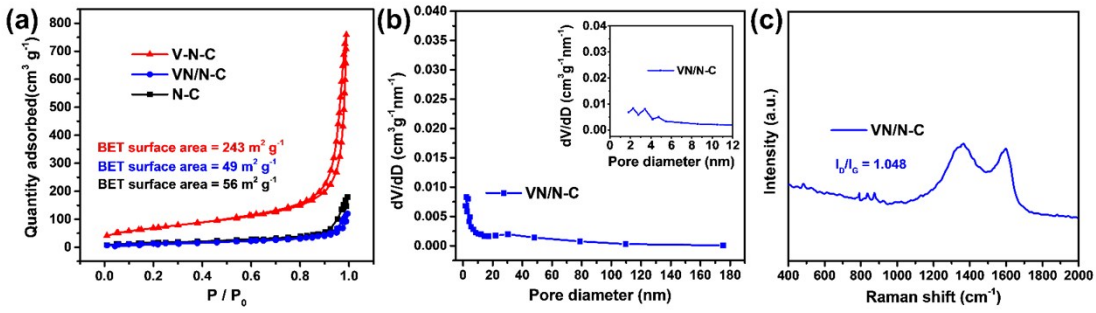


**Fig. S4.** (a) $N_2$ adsorption and desorption isotherms of V-N-C, VN/N-C and N-C samples. (b) Pore size distribution curve and (c) Raman spectrum of VN/N-C.

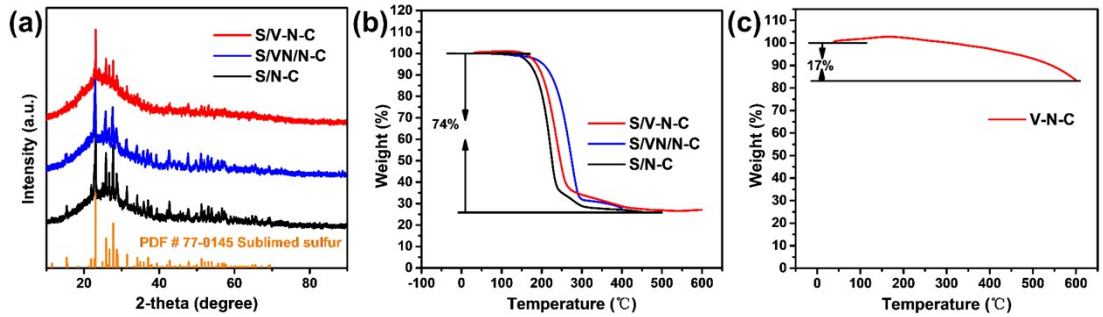


**Fig. S5.** (a) XRD patterns and (b) TGA results of the S/V-N-C, S/VN/N-C, and S/N-C samples. (c) TGA results of the V-N-C sample.

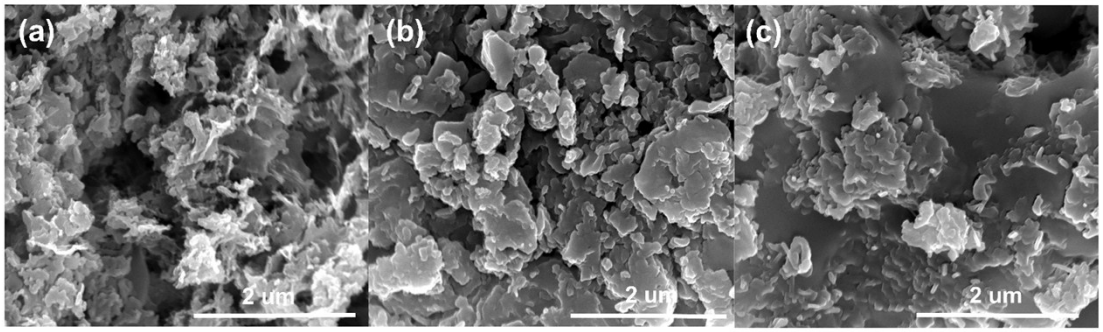


**Fig. S6.** SEM images of (a) S/V-N-C, (b) S/VN/N-C, and (c) S/N-C composites.

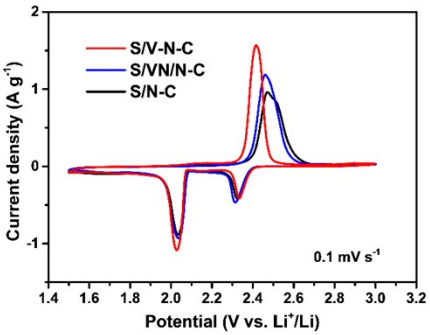


**Fig. S7.** Cycling voltammograms of S/V-N-C, S/VN/N-C, and S/N-C electrodes.

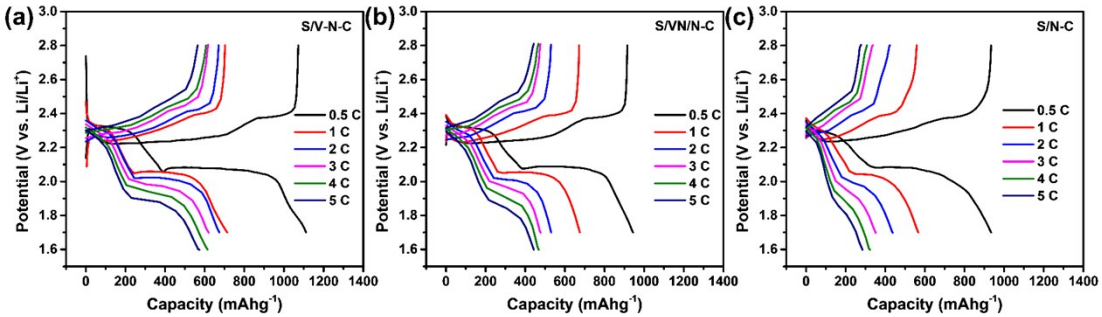


**Fig. S8.** Discharge-charge profiles of (a) S/V-N-C, (b) S/VN/N-C, and (c) S/N-C electrodes.

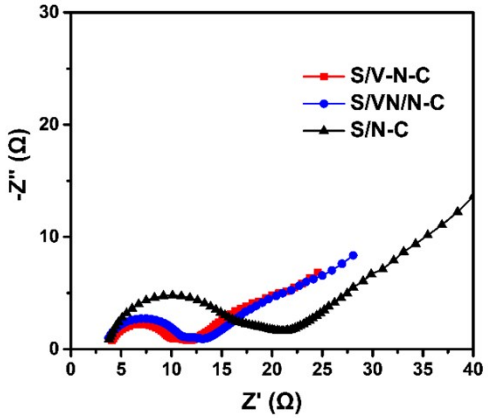


**Fig. S9.** EIS plots of the S/V-N-C, S/VN/N-C and S/N-C electrodes from 100000 Hz to 0.01 Hz. (The cells are on fully charged state after 20 cycles of discharge/charge at 0.5-3C rate)

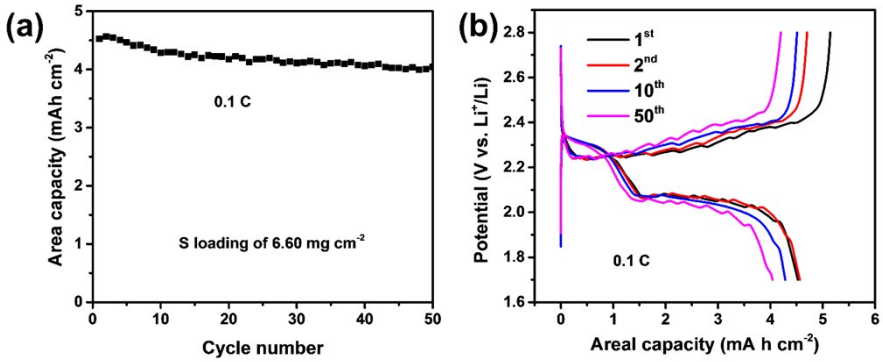


**Fig. S10.** (a) Cycling performance of S/V-N-C with a sulfur loading of 6.60 mg $cm^{-2}$ at 0.1C; (b) the corresponding areal capacity vs. potential curve of the high sulfur loading S/V-N-C.

**Tab. S1.** Elemental analyses of V-N-C and VN/N-C by XPS.

| **Samples** | **N (at. %)** | **V (at. %)** |
|---|---|---|
| **V-N-C** | 1.73 | 0.02 |
| **VN/N-C** | 1.61 | 0.53 |

**Tab. S2.** Comparison of rate performances based on sulfur hosts between this work and other reported studies.

| Hosts | Mass loading of S (mg $cm^{-2}$) | S content (wt%) | Current density | Capacity (mAh $g^{-1}$) | Ref. |
|---|---|---|---|---|---|
| V-N-C | 1 | 68.4 | 4C | 614.4 | This work |
| | | | 5C | 573.6 | |
| Co-VN@C | 1.3-1.5 | 70 | 4C | 590 | [1] |
| | | | 5C | 540 | |
| rGO-$VS_2$ | 1.15 | 64 | 5C | 401 | [2] |
| rGO | 1 | 63 | 1.5A $g^{-1}$ | 654 | [3] |
| Ni-MOF | - | 60 | 2C | 287 | [4] |

| | | | | | |
|---|---|---|---|---|---|
| Fe-PNC | 1.3 | 70 | 2C | ~280 | [5] |
| Co-NC | 1.3 | 64 | 3C | 478 | [6] |
| N-HPC-CNT (N-doped hierarchical porous carbon and CNT hybrids) | 1.5 | 62.5 | 2C | 400 | [7] |
| Co-N-C | - | 70 | 2C | 518.4 | [8] |

## References


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