Electronic Supplementary Information

Highly crinkled and interconnected N, O and S co-doped carbon nanosheets modified separator for efficient Li-S batteries

Yanan Zhu*[a,b], Yuanfu Deng[c] and Guohua Chen*[a]

[a] Department of Mechanical Engineering, Research Institute for Smart Energy, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong SAR, China.

[b] Present address: Xi'an Shiyou University, Xi'an, 710065, P. R. China.

[c] The Key Laboratory of Fuel Cell for Guangdong Province, School of Chemistry and Chemical Engineering, South China University of Technology, Guangzhou, China.

E-mail: zhuyanan@xsyu.edu.cn; ghchen1963@gmail.com

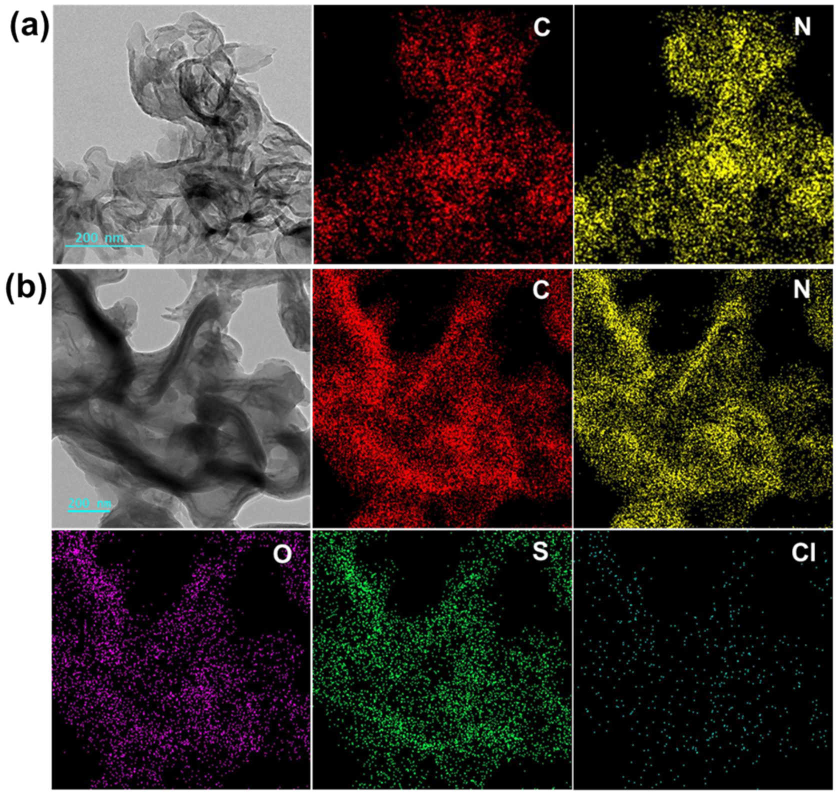

Fig. S1 EDS mapping images of (a) g-C_3N_4, and (b) g-C_3N_4@PCS

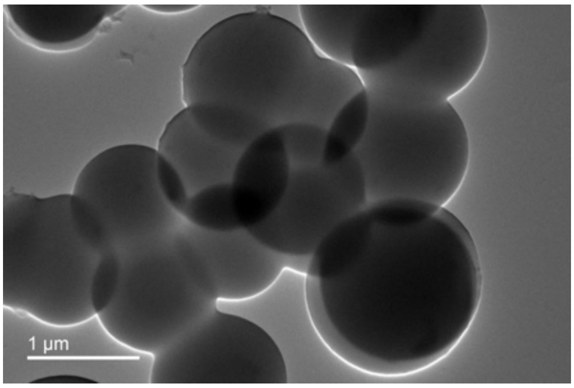

Fig. S2 TEM image of PCS without g-C_3N_4 templates

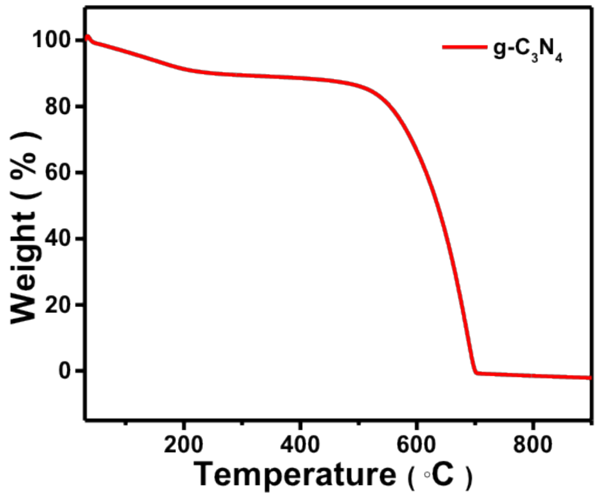

Fig. S3 TGA curve of g-C_3N_4

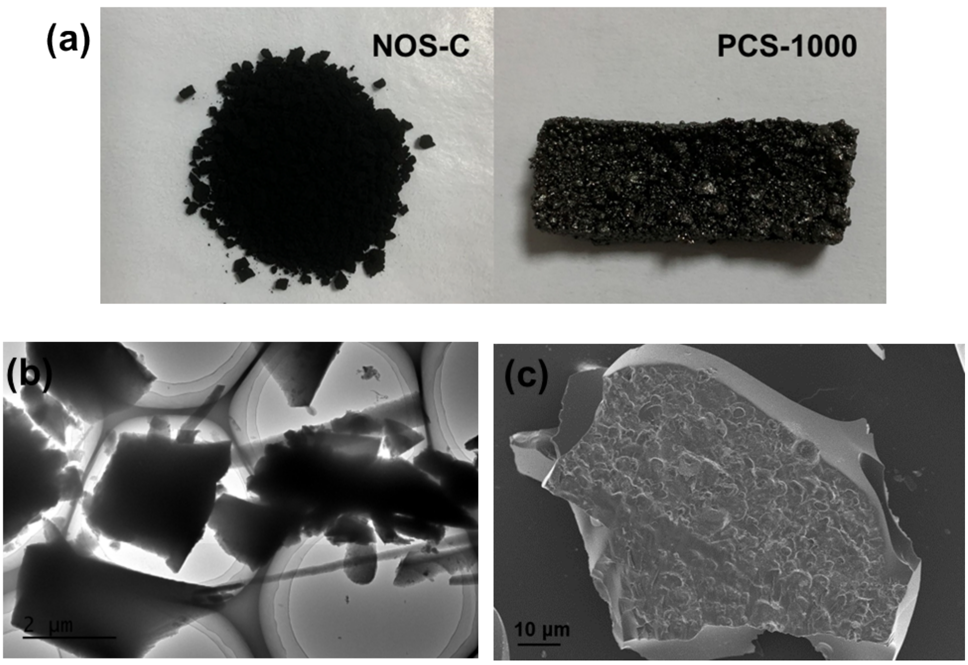

Fig. S4 (a) Photographs of NOS-C and PCS-1000, (b) TEM image of PCS-1000, and (c) SEM image of PCS-1000

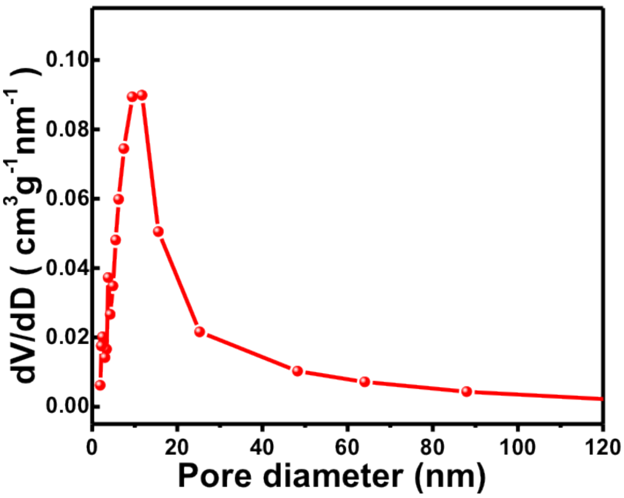

Fig. S5 BJH pore size distribution of NOS-C

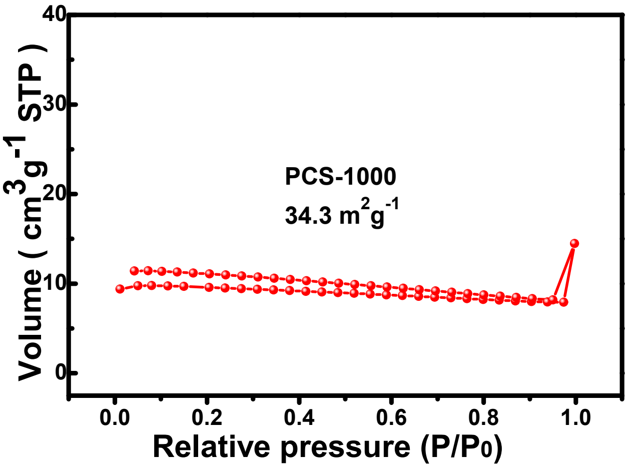

Fig. S6 N_2 adsorption–desorption isotherms of PCS-1000

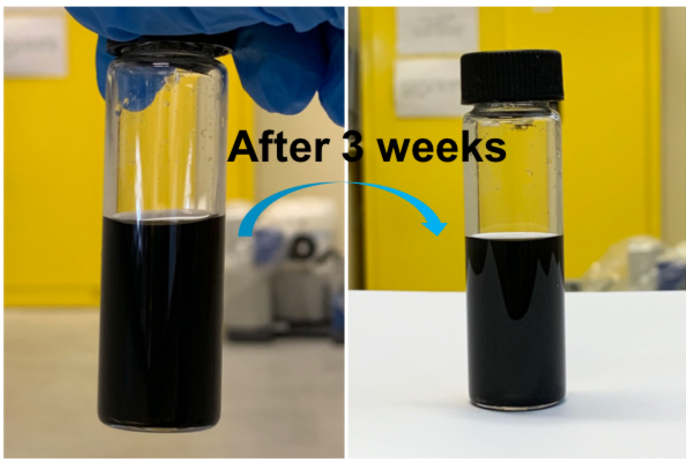

Fig. S7 Photographs of NOS-C dispersion after 3 weeks standing

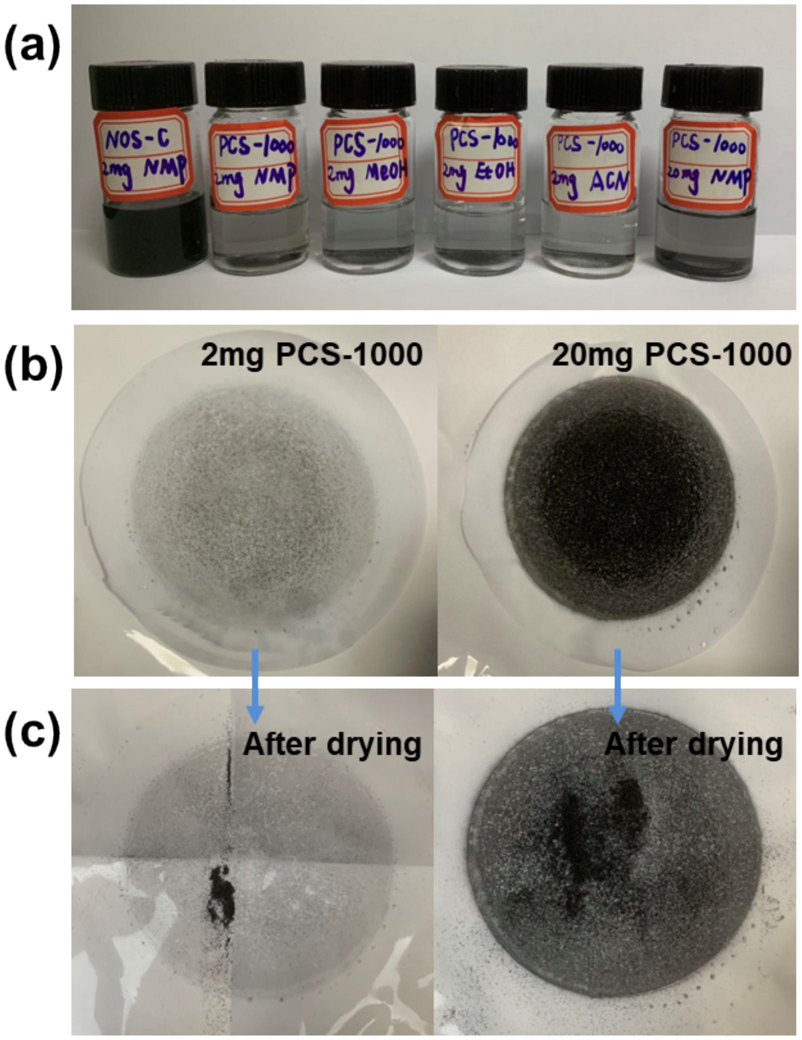

Fig. S8 Photograph of (a) the dispersion of NOS-C and PCS-1000 in the solvents, (b) PCS-10000 deposited on the Celgard separators via vacuum filtration, (c) PCS-1000 easily peeled off after drying

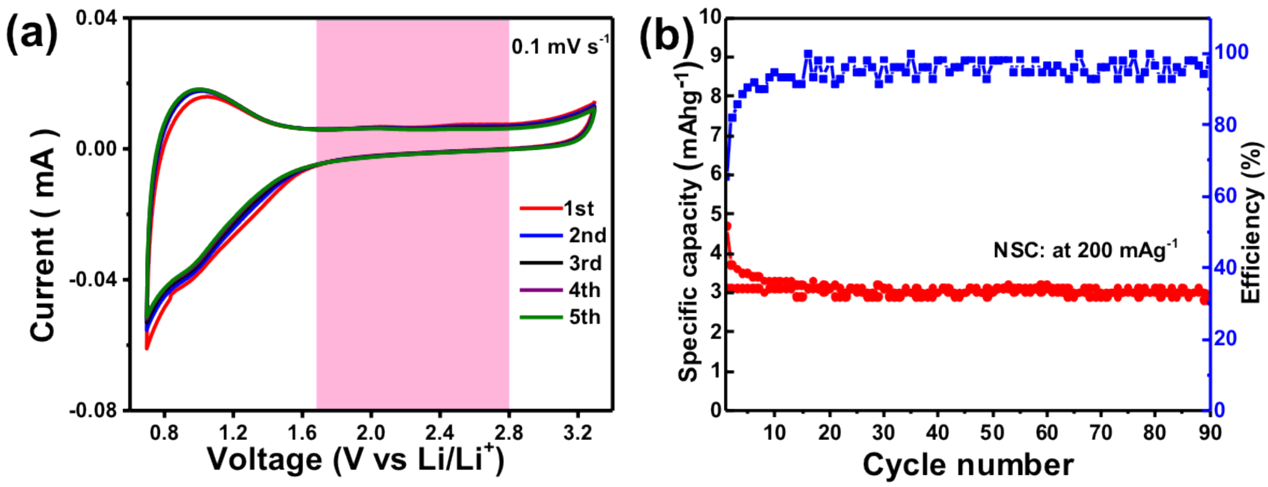

Fig. S9 (a) CV curves, and (b) cycling curves of the battery with the Celgard separator and the NOS-C electrode.

The electrochemical stability of NOS-C during the common voltage range of 1.7 V-2.8 V for Li-S batteries was tested (cathode: NOS-C, separator: Celgard). The cyclic voltammogram (CV) curves at 0.1 mV s^{-1} (Fig. S9a) showed that no delithiation peaks were detected in the voltage window. The Li storage capacities (~3 mAh g^{-1}, Fig. S9b) were negligible.

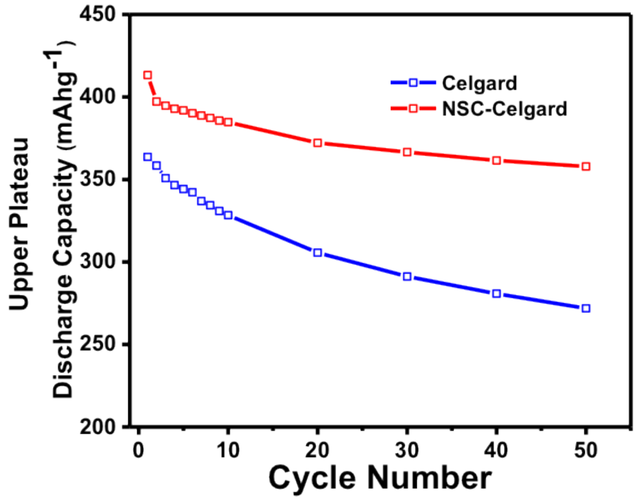

Fig. S10 The upper discharge capacities for the first 50 cycles.

As shown in Fig.S10, the initial Q_H of the battery with the NOS-C-Celgard separator at 0.5 C was 413.3 mAh g^{-1}, which was 98% of the theoretical value (419 mAh g^{-1}). However, the battery with the Celgard separator only reached 363.7 mAh g^{-1}. After 50 cycles, the battery with the NOS-C-Celgard separator showed a retention rate of 88.6% of the initial Q_H, higher than that with the Celgard separator (73.2%).

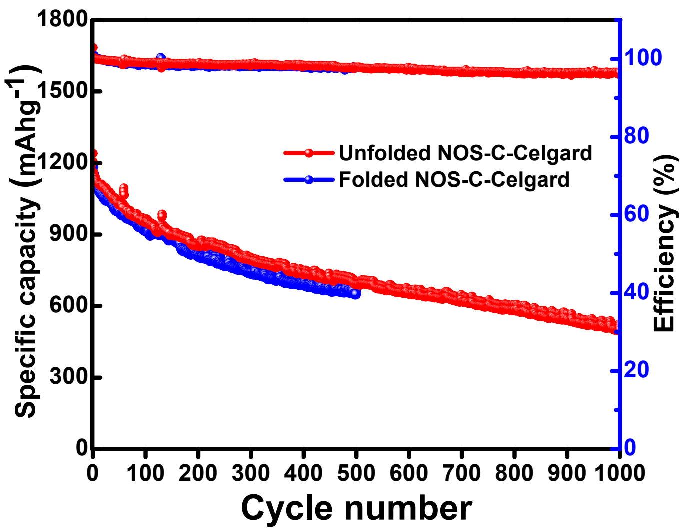

Fig. S11 The cycling performances of the batteries with the folded and unfolded NOS-C-Celgard separators at 0.5 C

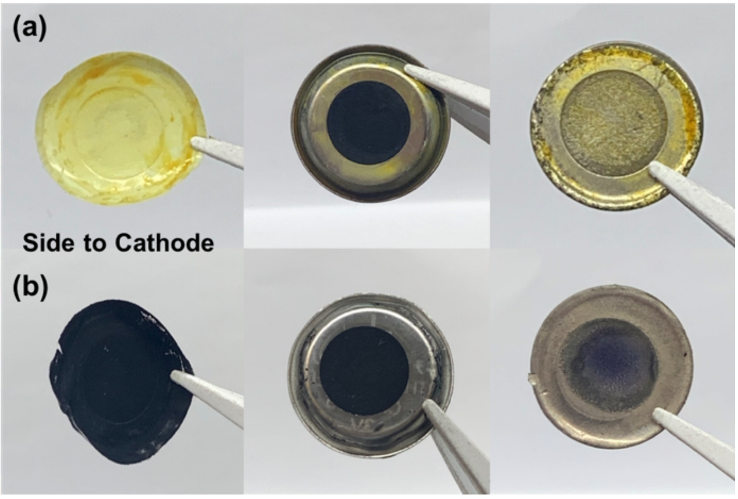

Fig. S12 Photographs of the disassembled batteries after cycling, (a) the battery with Celgard separator, (b) the battery with the NOS-C-Celgard separator

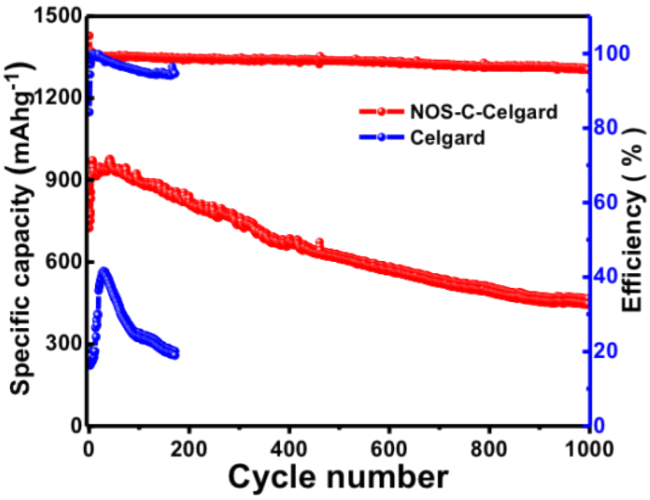

Fig. S13 Long-term cycling performance for the pure S cathode with the NOS-C-Celgard and Celgard separators

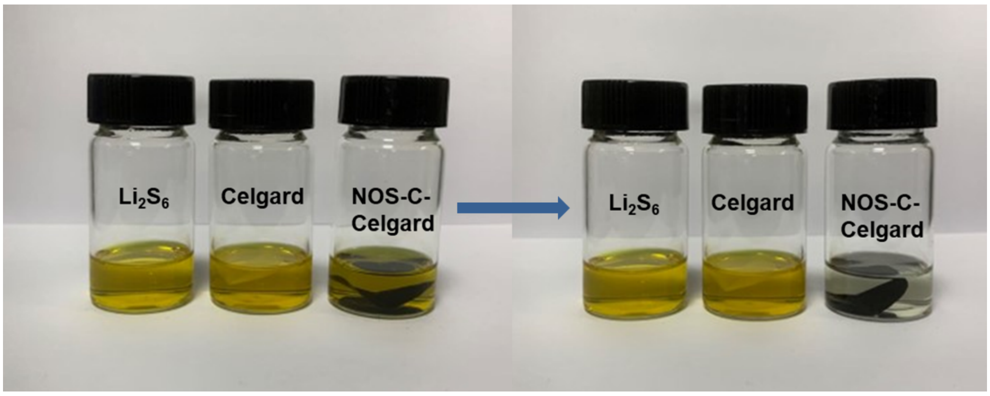

Fig. S14 Photographs of polysulfides adsorption test

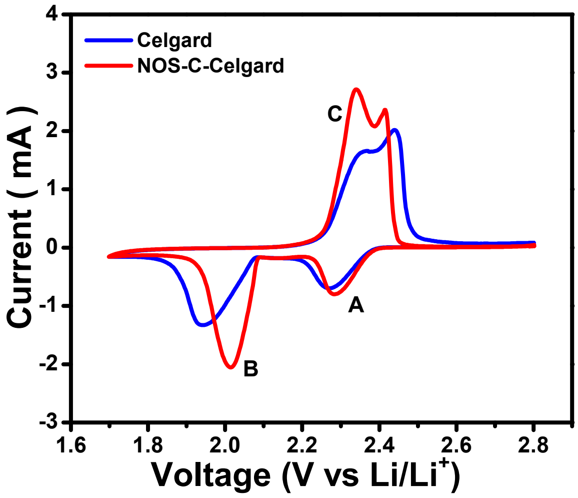

Fig. S15 CV curves at 0.1 mV s^{-1} of the batteries with the NOS-C-Celgard and Celgard separators