

## Supporting Information

### High sulfur loading composite wrapped by 3D nitrogen-doped graphene as cathode material for lithium-sulfur batteries

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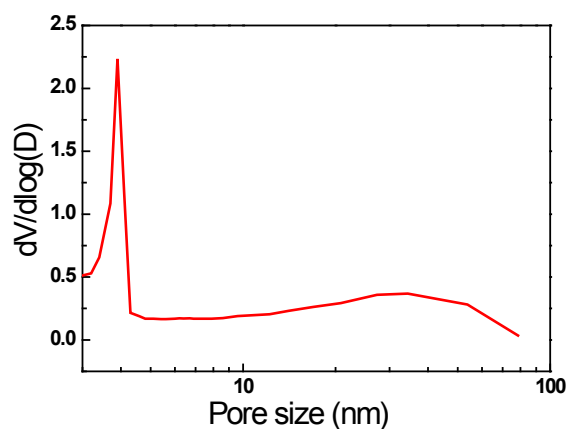
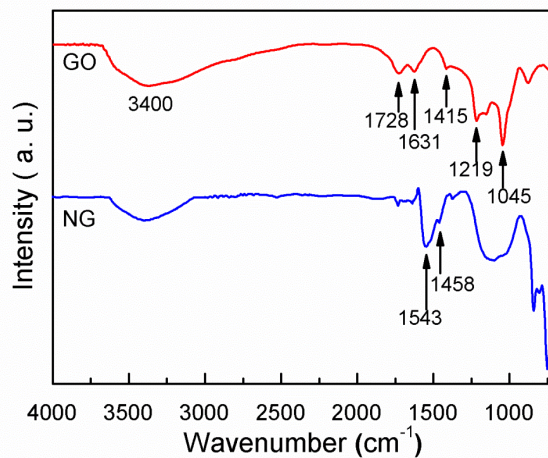
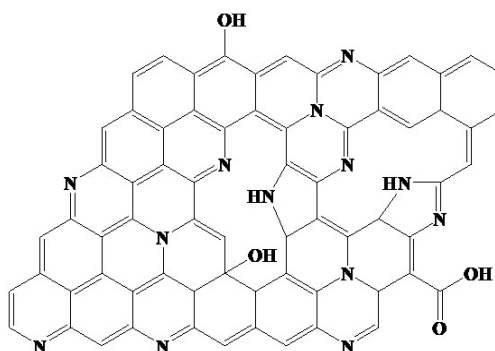


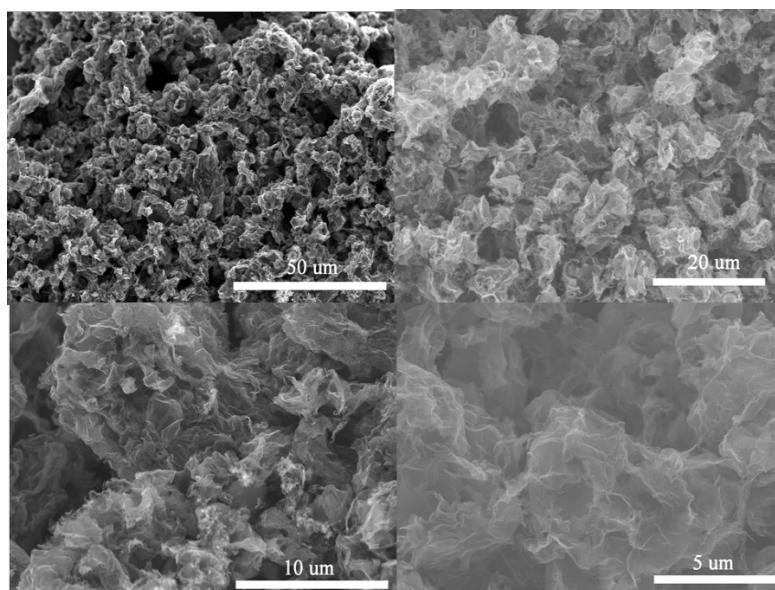
Fig. S1 Pore size distribution of the 3D-NG sample.



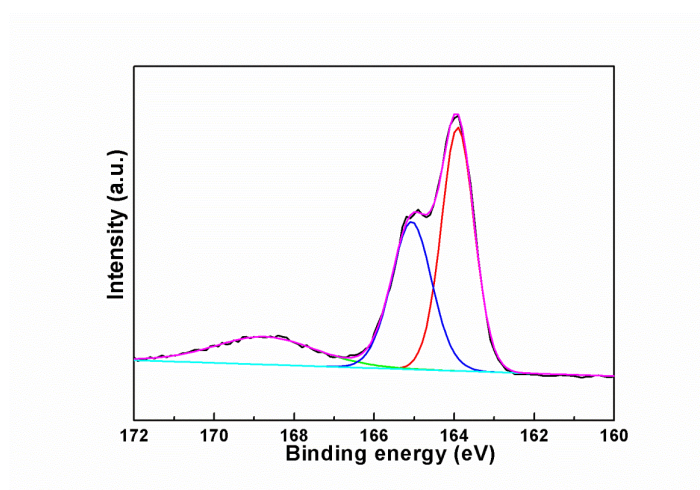
**Fig. S2** FTIR spectra of GO and NG. For GO, the main peaks centered at 1045, 1219, 1415, 1631, 1728 and 3400  $\text{cm}^{-1}$  can be ascribed to alkoxy C–O, epoxy C–O and C–OH, carboxyl O=C–O, aromatic C=C, C=O (carboxylic acid and carbonyl moieties), and O–H stretches, respectively.



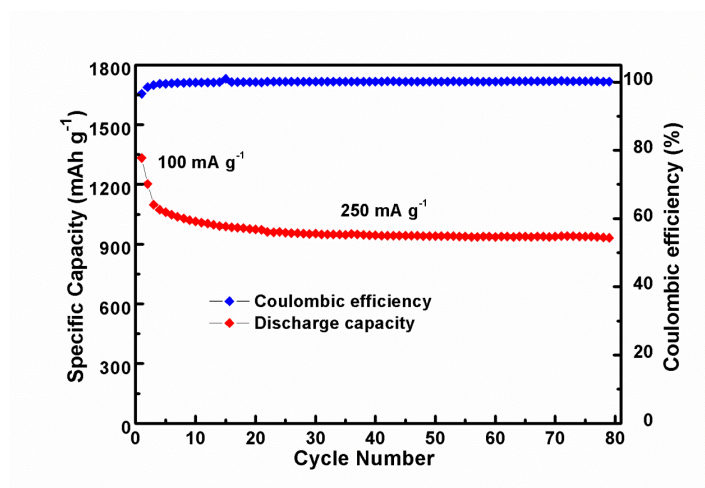
**Fig. S3** Structural scheme of the N-doped graphene.



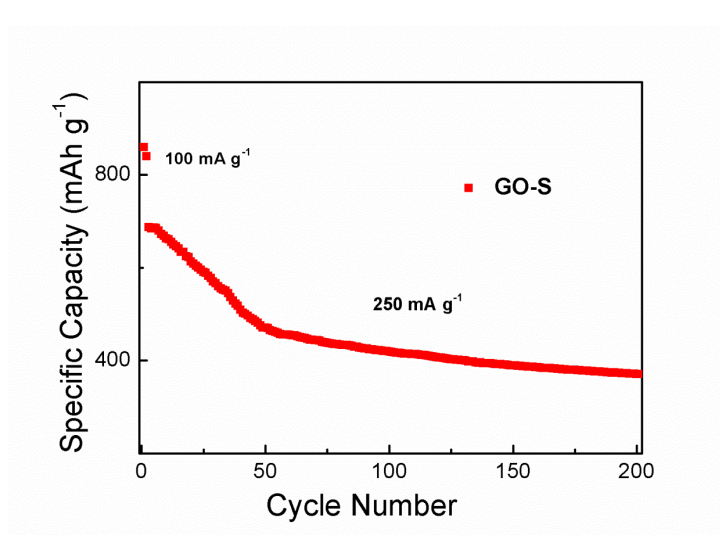
**Fig. S4** SEM images of 3D-NGS with different magnification.



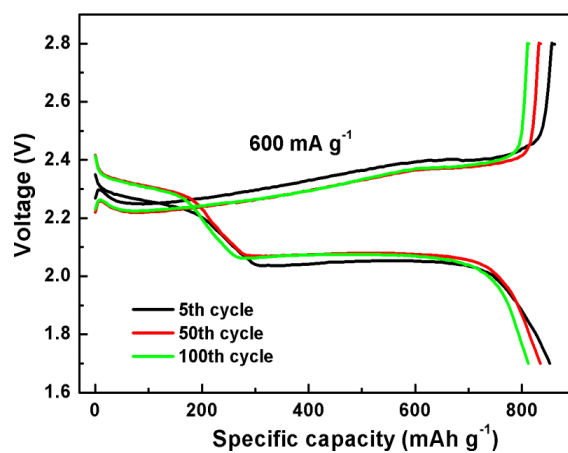
**Fig. S5** XPS spectra of S 2p in 3D-NGS.



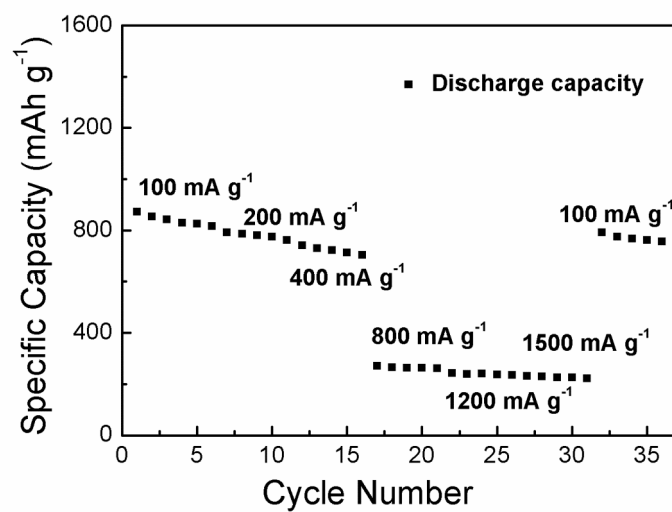
**Fig. S6** Cycling stability and corresponding coulombic efficiency at a current density of  $100 \text{ mA g}^{-1}$  at the initial two cycles and  $250 \text{ mA g}^{-1}$  for 3D-NGS.



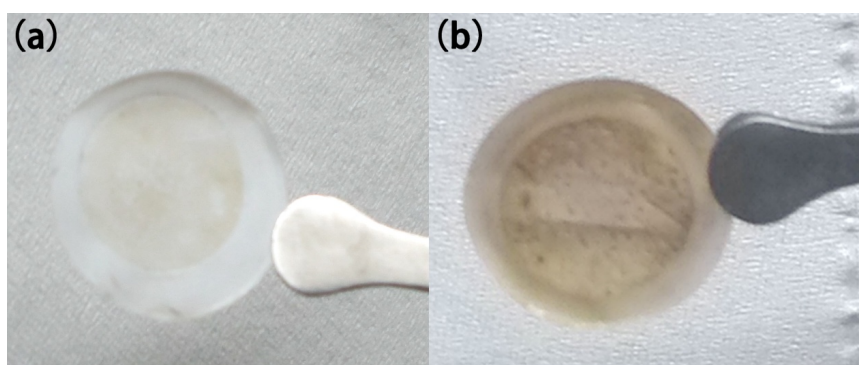
**Fig. S7** Specific discharge capacity at  $250 \text{ mA g}^{-1}$  for GO-S composite.



**Fig. S8** Charge and discharge profiles at  $600 \text{ mA g}^{-1}$  for 3D-NGS composite.



**Fig. S9** Rate performance of GO-S composite.



**Fig. S10** Photograph of the separator after running at 1500 mA g<sup>-1</sup> for 200 cycles:  
(a) 3D-NGS, (b) GO-S.