Supporting Information

Efficient synthesis of graphene/sulfur nanocomposites with high sulfur content and their application as cathode for Li-S batteries

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Fig. S1. The digital photos of (a) the 3 mg L^{-1} GO solution (I) and the GO solution bubbled with H_2S for 2h (II) at room temperature, (b) 5mL 0.086% H_2O_2 was bubbled into H_2S, (c) 3 mg L^{-1} GO solution was bubbled into H_2S at 70 °C for 2h.

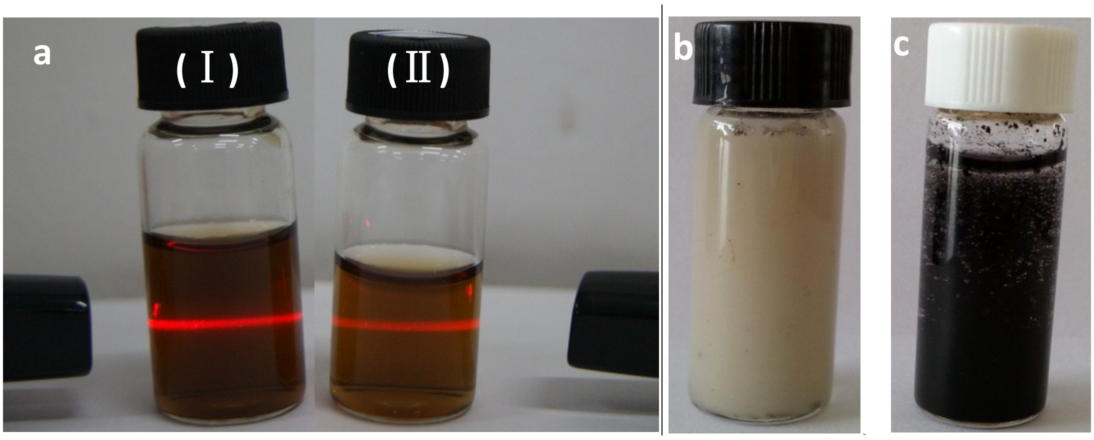

Fig. S2. The calculation steps of the theoritical value for sulfur content in the GS/S compoistes produced by adding different quantities of 30 wt.% H_2O_2 solution.

Firstly, The following data should be obtained:

(1) The sulfur content of GS/S composite produced by the reaction between the GO and H_2S at 70 °C. The process was following:

H_2S gas was bubbled into the 50 mL 3mg mL^{-1} GO solution at 70 °C for 2h. The black harvest was centrifuged, and then washed by deionized water until pH=7. After dried at 80 °C, 86.8 mg balack powders were obtained. The accurate sulfur content of the GS/S composite obtained by thermogravimetric analysis (TGA) was 41.8 wt.%.

(2) The actual yield of sulfur for the reaction between H_2S and H_2O_2. The process was

following: 1.0 mL 30 wt.% H_2O_2 solution (ρ= 1.1 g mL^{-1}) was added in the 50 mL deionized water, then the H_2S gas was bubbled into this solution at room temperature for 2h. The mixture with milk-white appearance was centrifuged, and then washed by deionized water until pH=7. After dried at 50 ^{o}C, 308.2 mg faint yellow powders were obtained, which was almost equalled to the theoritical value (310.0 mg).

Secondly, the theoritical value of sulfur content in the GS/S compoistes was calculated according to the following formula (1):

$$S\% = \frac{86.8\times 40.8\% + 308.2V_{H2O2}}{86.8 + 308.2V_{H2O2}} \times 100\% \qquad (1)$$

Where V_{H2O2} means the volume of 30 wt.% H_2O_2, its unit is milliliter (mL).

So if 0.14 mL 30 wt.% H_2O_2 was added into the 50 mL 3 mg L^{-1} GO solution, the theoritical value of sulfur content in the GS/S compposite is 60.4 wt.%, calculating process as following formula (2):

$$S\% = \frac{86.8\times 40.8\% + 308.2\times 0.14}{86.8 + 308.2\times 0.14} \times 100\% = 60.4\% \qquad (2)$$

So if 0.27 mL 30 wt.% H_2O_2 was added into the 50 mL 3 mg L^{-1} GO solution, the theoritical value of sulfur content in the GS/S compposite is 69.8 wt.%, calculating process as following formula (3):

$$S\% = \frac{86.8\times 40.8\% + 308.2\times 0.27}{86.8 + 308.2\times 0.27} \times 100\% = 69.8\% \qquad (3)$$

So if 0.55 mL 30 wt.% H_2O_2 was added into the 50 mL 3 mg L^{-1} GO solution, the theoritical value of sulfur content in the GS/S compposite is 80.0 wt.%, calculating process as following formula (4):

$$S\% = \frac{86.8\times 40.8\% + 308.2\times 0.55}{86.8 + 308.2\times 0.55} \times 100\% = 80.0\% \qquad (4)$$

Fig. S3. XRD patterns of (a) GS/S-70 produced by bubbling H_2S into the solution of GO

and H_2O_2, (b) S-H_2O_2 by bubbling H_2S into the H_2O_2 solution, (c) GS/cS produced by bubbling into the mixture of graphene obtained by heating GO at 700 °C for 1h in the nitrogen atmosphere and H_2O_2.

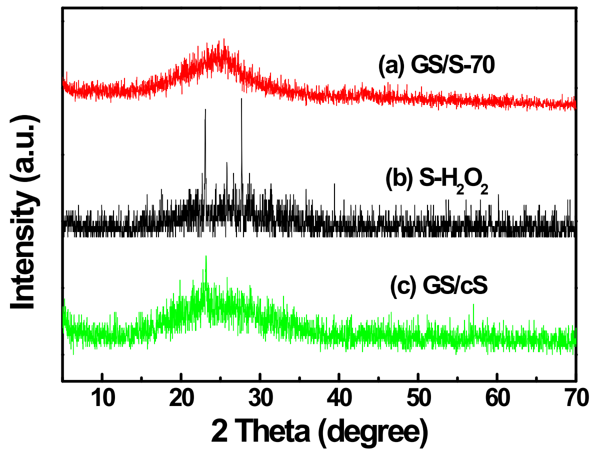

Fig. S4. The charge-discharge profiles of GS/S-70 composite at different current density.

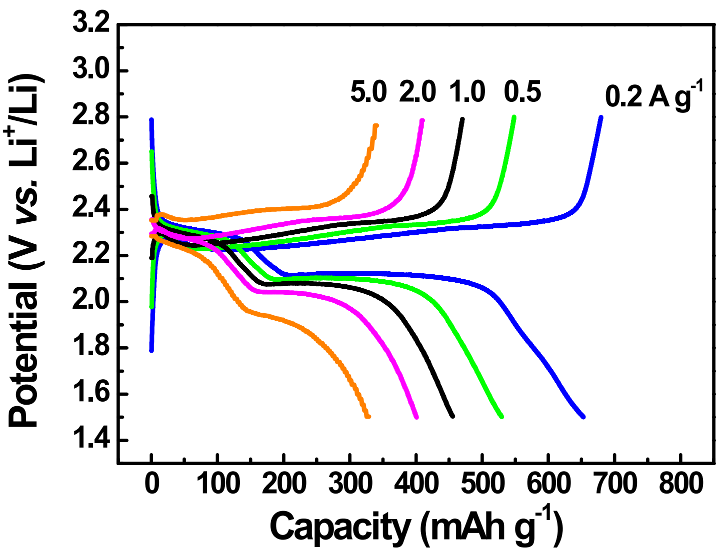

Fig. S5. The rate performance of GS/S-70 and GS/cS-70 for the Li-S battery.

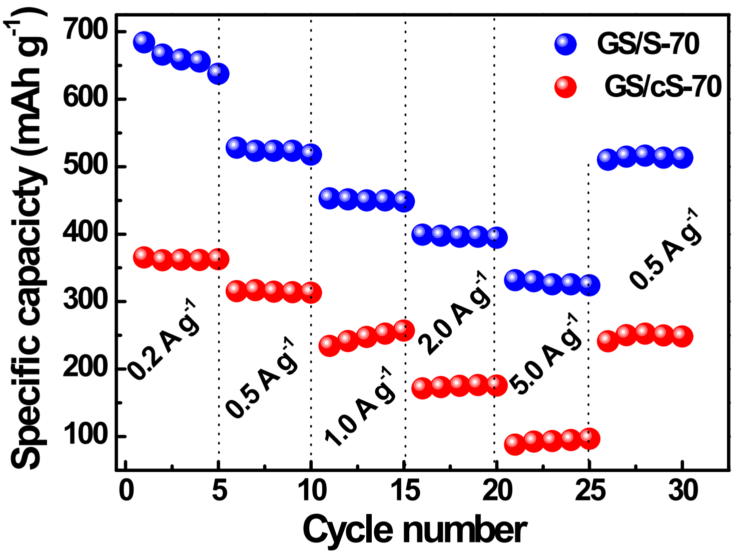

Fig. S6. The EIS measurements of the GS/S-40, GS/S-60, GS/S-70 and GS/S-80 composites.