Protective interlayer for trapping polysulfides and conducting host for sulfur: Dual role of candle soot carbon for the development of high performance Lithium-Sulfur battery

Vikram K. Bharti, Ananya Gangadharan, S. Krishna Kumar, Anil D. Pathak, Chandra S. Sharma*

Creative & Advanced Research Based On Nanomaterials (CARBON) Laboratory,
Department of Chemical Engineering, Indian Institute of Technology Hyderabad,
Kandi-502285, Telangana

*Corresponding author: Email: cssharma@che.iith.ac.in

Supporting information

Fig. S1 (a) Collecting candle soot from the tip of the flame (b) collected candle soot.
Fig. S2 SEM image of (a) SC (b) C-SC; EDAX analysis of (c) SC (d) C-SC.
**Fig. S3** CV of C-SC at the scan rate of 0.1 mV.s\(^{-1}\).

**Fig. S4** Digital image of glass fiber separator (a) before cycling (b) after cycling [100 cycles] using SC as cathode; (c) after cycling [200 cycles] using C-SC as cathode.
Equation S1: Set of possible interaction between higher order polysulfides and carbon interlayer:

A. Possible interactions of Li$_2$S$_4$
   I. Li$_2$S$_4$ + C $\rightarrow$ C-Li$_2$S$_4$
   II. Li$_2$S$_6$-C + Li$_2$S$_4$ $\rightarrow$ Li$_2$S$_6$-C-Li$_2$S$_4$
   III. Li$_2$S$_8$-C + Li$_2$S$_4$ $\rightarrow$ Li$_2$S$_8$-C-Li$_2$S$_4$

B. Possible interactions of Li$_2$S$_6$
   I. Li$_2$S$_6$ + C $\rightarrow$ C-Li$_2$S$_6$
   II. Li$_2$S$_4$-C + Li$_2$S$_6$ $\rightarrow$ Li$_2$S$_4$-C-Li$_2$S$_6$
   III. Li$_2$S$_8$-C + Li$_2$S$_6$ $\rightarrow$ Li$_2$S$_8$-C-Li$_2$S$_6$

C. Possible interactions of Li$_2$S$_8$
   I. Li$_2$S$_8$ + C $\rightarrow$ C-Li$_2$S$_8$
   II. Li$_2$S$_4$-C + Li$_2$S$_8$ $\rightarrow$ Li$_2$S$_4$-C-Li$_2$S$_8$
   III. Li$_2$S$_6$-C + Li$_2$S$_8$ $\rightarrow$ Li$_2$S$_6$-C-Li$_2$S$_8$