Electronic Supplementary Information (ESI) for

# Enhanced electrochemical performance of lithium ion batteries using $Sb_2S_3$ nanorods and graphene composites as anode materials

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## Synthesis of graphene oxide

First, the graphite powder was oxidized using 0.9 g $NaNO_3$ and 37 mL of concentrated $H_2SO_4$ that were added to 1 g graphite powder cooled in an ice bath. This mixture was continuously stirred while 5 g of $KMnO_4$ was added slowly over 1 h. It was left to stir for 2 h in the ice bath, and then removed and left for 4 days under continuous stirring. A black viscous liquid was obtained and 100 mL of deionized water was added over 30 min while stirring continuously. The mixture was stirred for a further 2 h, 10 mL $H_2O_2$ (30wt% aqueous solution) was slowly added and then the mixture was left to stir for another 2 h. The resulting oxidized material was washed three times by 10wt% diluted hydrochloric acid and then washed by deionized water till the pondus hydrogenii (pH) value was close to 7. A light yellow GO powder was obtained after freeze drying for 12 h.

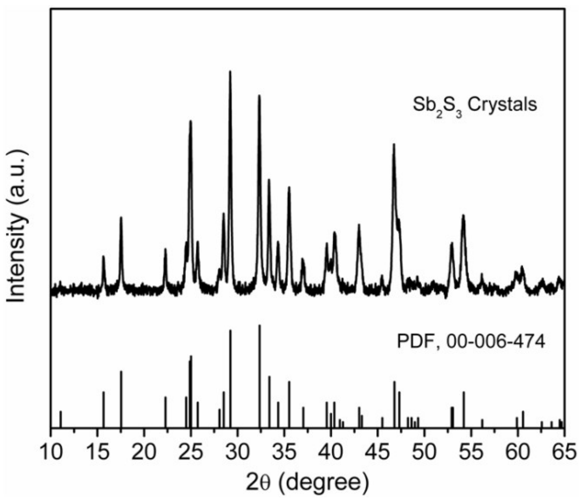


Fig. 1S XRD pattern of $Sb_2S_3$ crystals.

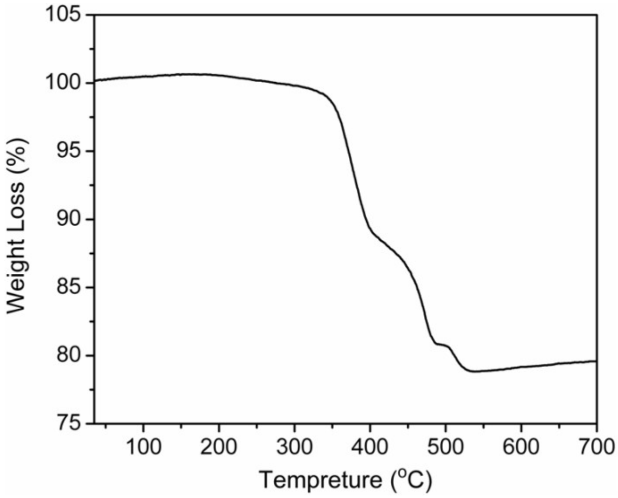

Fig. 2S TGA curve of $Sb_2S_3$/G composites.

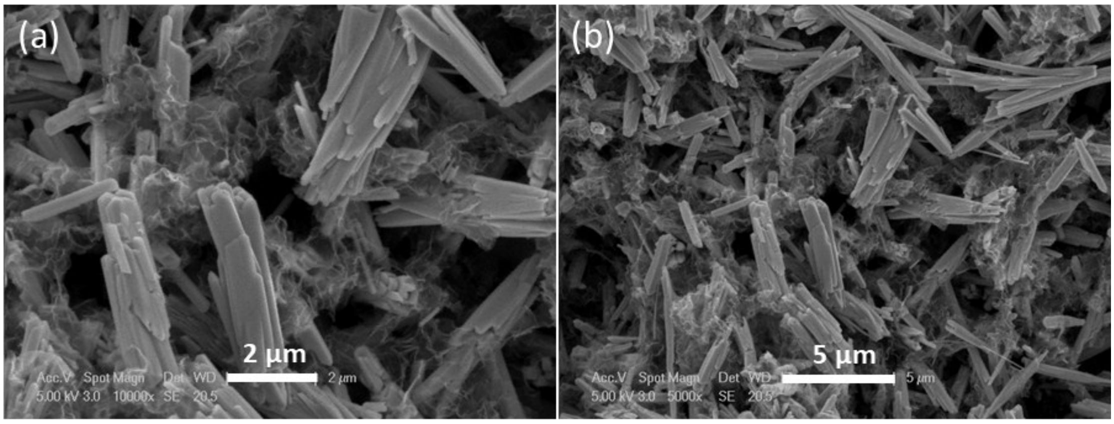

Fig. 3S SEM images of $Sb_2S_3$/G composites with half amount of GO with different magnification.

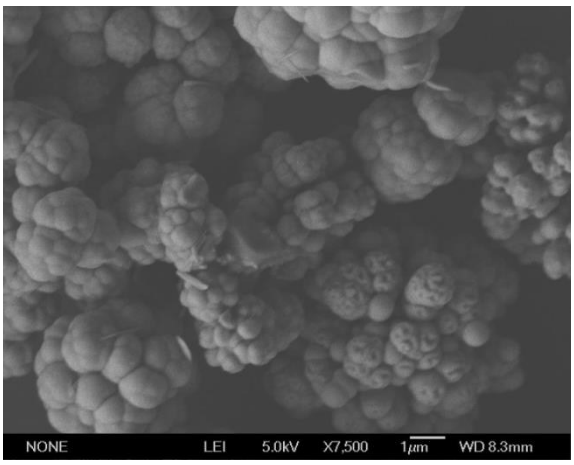

Fig. 4S SEM image of $Sb_2S_3$ crystals.

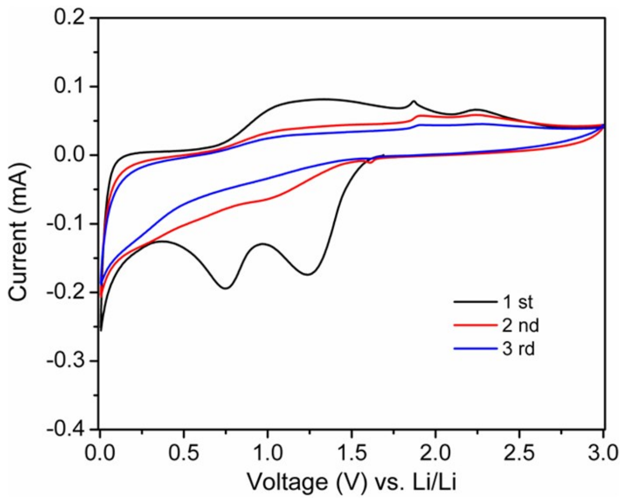

Fig. 5S CV of $Sb_2S_3$ crystals at a scan rate of 0.1 mV $s^{-1}$ in the voltage range of 0.01-3 V (*vs.* $Li^+/Li$).

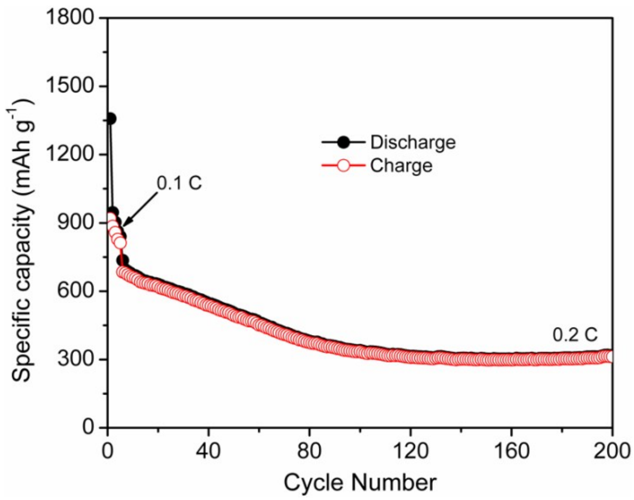

Fig. 6S Cyclic stability of $Sb_2S_3$/HG composites at various current rates.

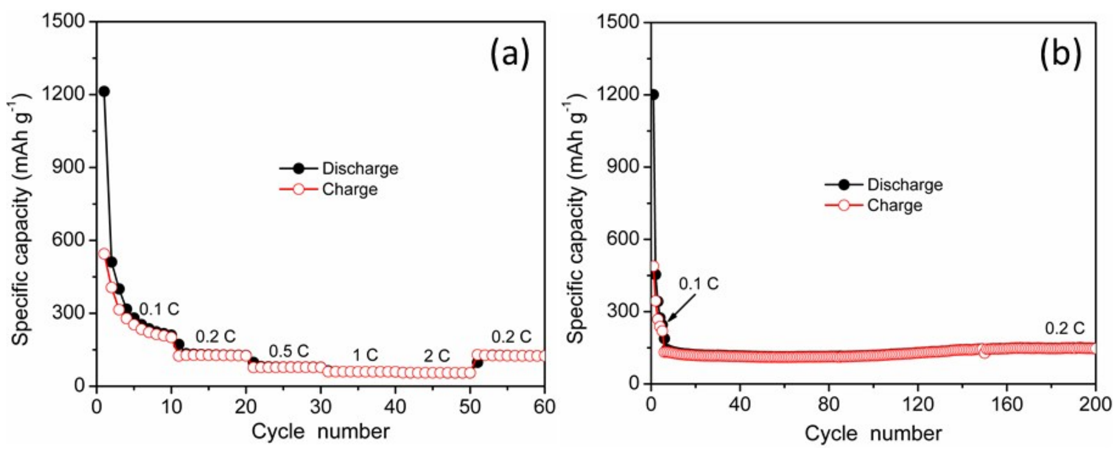

Fig. 7S (a) Rate capacity of $Sb_2S_3$ crystals at various current rates; and (b) cyclic stability of $Sb_2S$ crystals.

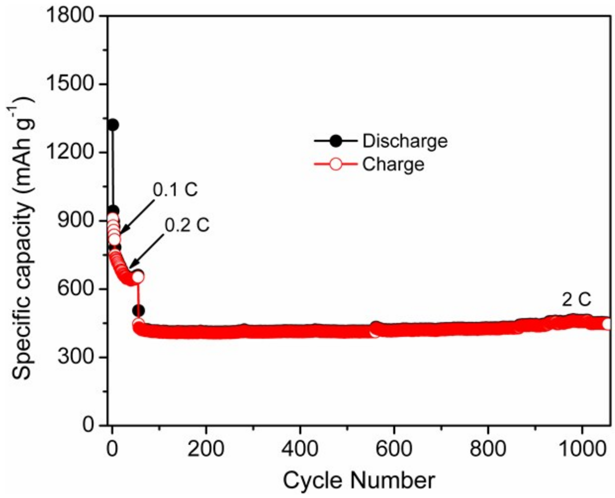


Fig. 8S Cyclic stability of $Sb_2S_3$/G composites tested at various current rates.

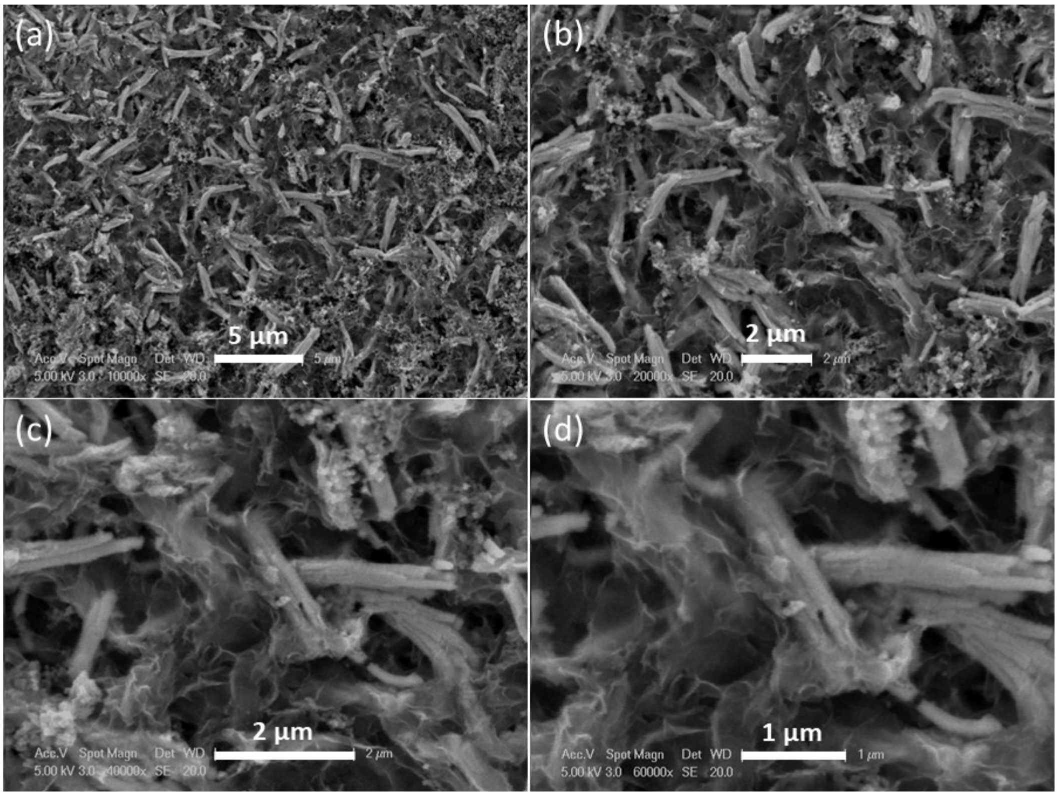


Fig. 9S SEM image of $Sb_2S_3$/G composites with different magnification after 100 cycles at a current rate of 0.2C