Supporting information

Facile synthesis of laminate-structured graphene sheets-Fe_3O_4 nanocomposites with superior high reversible specific capacity and cyclic stability for lithium-ion batteries

Chundong Wang,[1] Qiumei Zhang,[2] Qi-Hui Wu,[1] Tsz-Wai Ng,[1] Tailun Wong,[1] Jianguo Ren,[1] Zhicong Shi,[2] Chun-Sing Lee,[1] Shuit-Tong Lee,[1] Wenjun Zhang[1*]

[1] Center of Super-Diamond and Advanced Films (COSDAF) and Department of Physics and Materials Science, City University of Hong Kong, Hong Kong SAR, China.

[2] Center for Green Products and Processing Technologies, Guangzhou HKUST FOK Ying Tung Research Institute, Guangzhou 511458, China.

[*] Author to whom correspondence should be addressed. Tel: +852 34427433 E-mail: apwjzh@cityu.edu.hk .

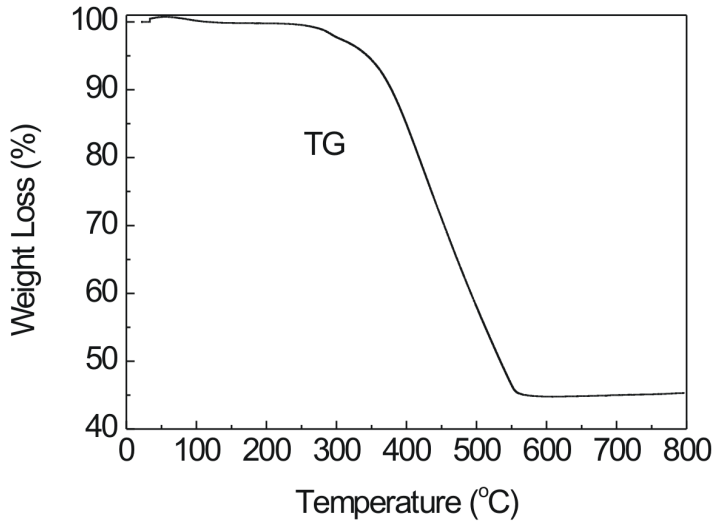

Fig. S1 TG curve of another GNS-Fe_3O_4 composite, i.e. GNS-Fe_3O_4-#, performed under the same conditions as indicated in Fig. 5.

The result shows that the amount of graphene in the GNS-Fe_3O_4-# nanocomposite is ~ 56.5 wt% after consideration of the combustion of graphene and oxidation of Fe_3O_4 to Fe_2O_3.

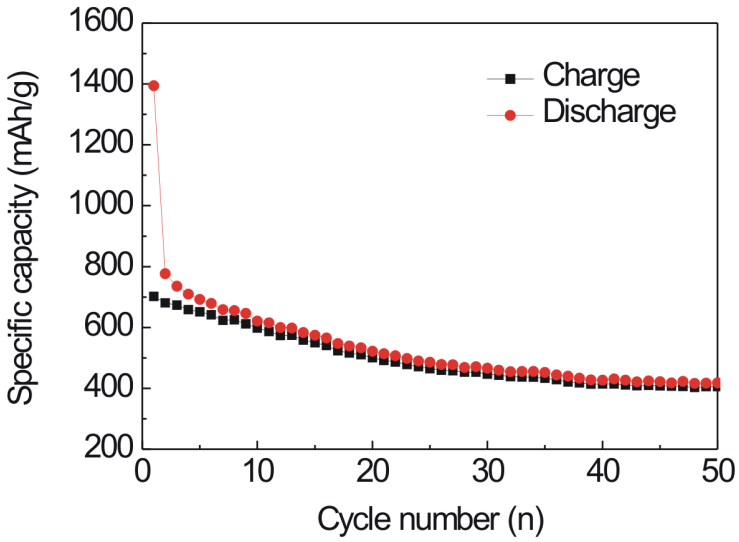

Fig. S2 Cycle performances of as-prepared TEGO after annealed at 400°C for 4 hours in Ar atmosphere between 0.0 and 3.0 V vs Li/Li^+ at a current density of 100mA/g.

It is interesting to note that though the capacity of the TEGO increases after annealed under Ar atmosphere, however, it keeps decreasing with charge and discharge processes. This phenomenon is different from the pristine TEGO and GNS-Fe_3O_4 nanocomposites, which presents a stable cycling performance. The annealing effect on TEGO is needed further investigation.

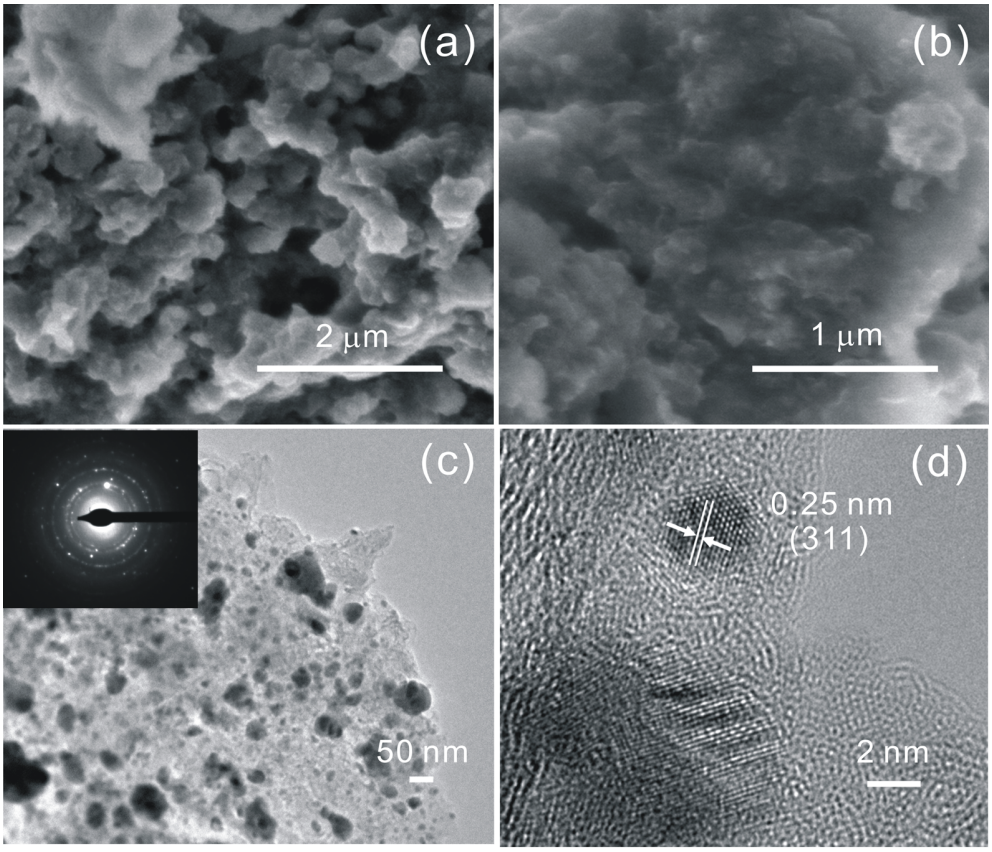

Fig. S3 SEM and TEM images of GNS-Fe_3O_4 nanocomposites after performing 50 cyclys at 100mA/g. (a)-(b) SEM images of GNS-Fe_3O_4 nanocomposites with different magnification, (c) TEM image of GNS-Fe_3O_4 nanocomposites, (d) high resolution TEM image of Fe_3O_4 nanoparticles anchored on graphene sheets. The inset of (c) is the SAED of GNS-Fe_3O_4.

Fig. S3 demonstrates the SEM and TEM images of GNS-Fe_3O_4 nanocomposites after performing 50cyclys at 100mA/g. The cell was detached in a glove box, and then washed with atone, alcohol and Deionized water in sequence for several times. Due to the existing trace polymer from the electrolyte during charge and discharge process, the SEM images are not so clearly observable as the pristine ones. In Figs. S3 (a) and (b), one can clearly find that dense and slick SEI films are formed. In addition, it also reveals that

even after long cycles, Fe_3O_4 nanoparticles are still closely embedded in graphene sheets and the morphology as well as particles size are almost unchanged compared with the initial state, which can also be confirmed from low magnification TEM and HRTEM images in Figs. S3 (c) and (d). In Fig. S3 (c), it verifies the fact that the flexible graphene sheets effectively prevent the agglomeration of Fe_3O_4 nanoparticles by relaxing their strain and stress of volume change during charge-discharge processes, which further enhance the cyclic stability and rate capacity. In addition, noting that after long cycles, the Fe_3O_4 nanoparticle is still polycrystalline as the initial state indicating by the SAED image of GNS-Fe_3O_4 in the set of Fig. S3 (c) and the HRTEM in Fig. S3 (d).