Electronic Supplementary Information

Sandwich-like porous TiO_2/reduced graphene oxide (rGO) for high-performance lithium-ion batteries

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***Materials*:** $TiCl_4$ and ethanol were provided by Beijing Chemical Reagent Company. Graphenen oxide (GO) was synthesized from natural graphite powder by a modified Hummers method, as reported elsewhere. Titanium(III) chloride, 20% in 3% hydrochloric acid) was produced by Alfa Aesar.

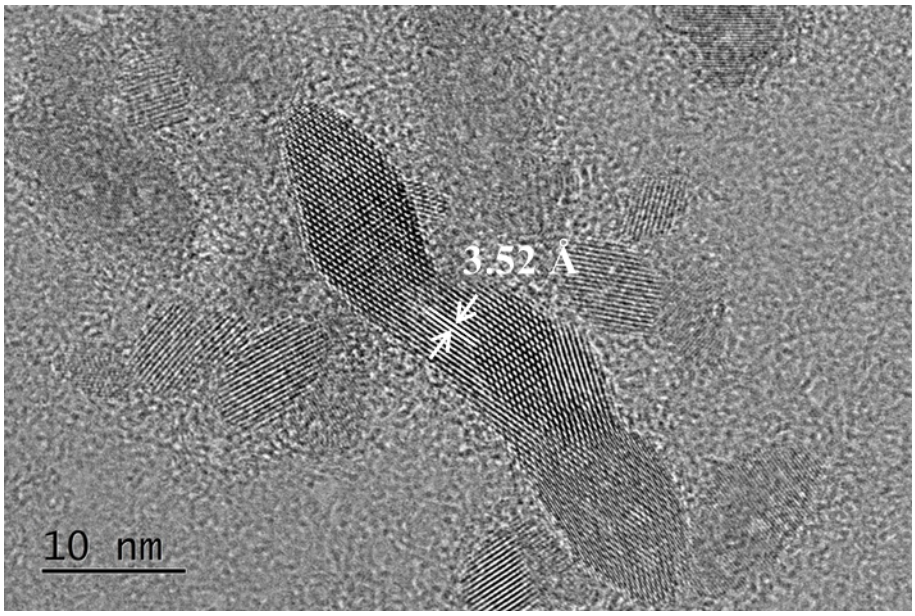

Fig. S1 HRTEM image of **T-200**. The (101) crystal face (3.52 Å) of anatase could be seen.

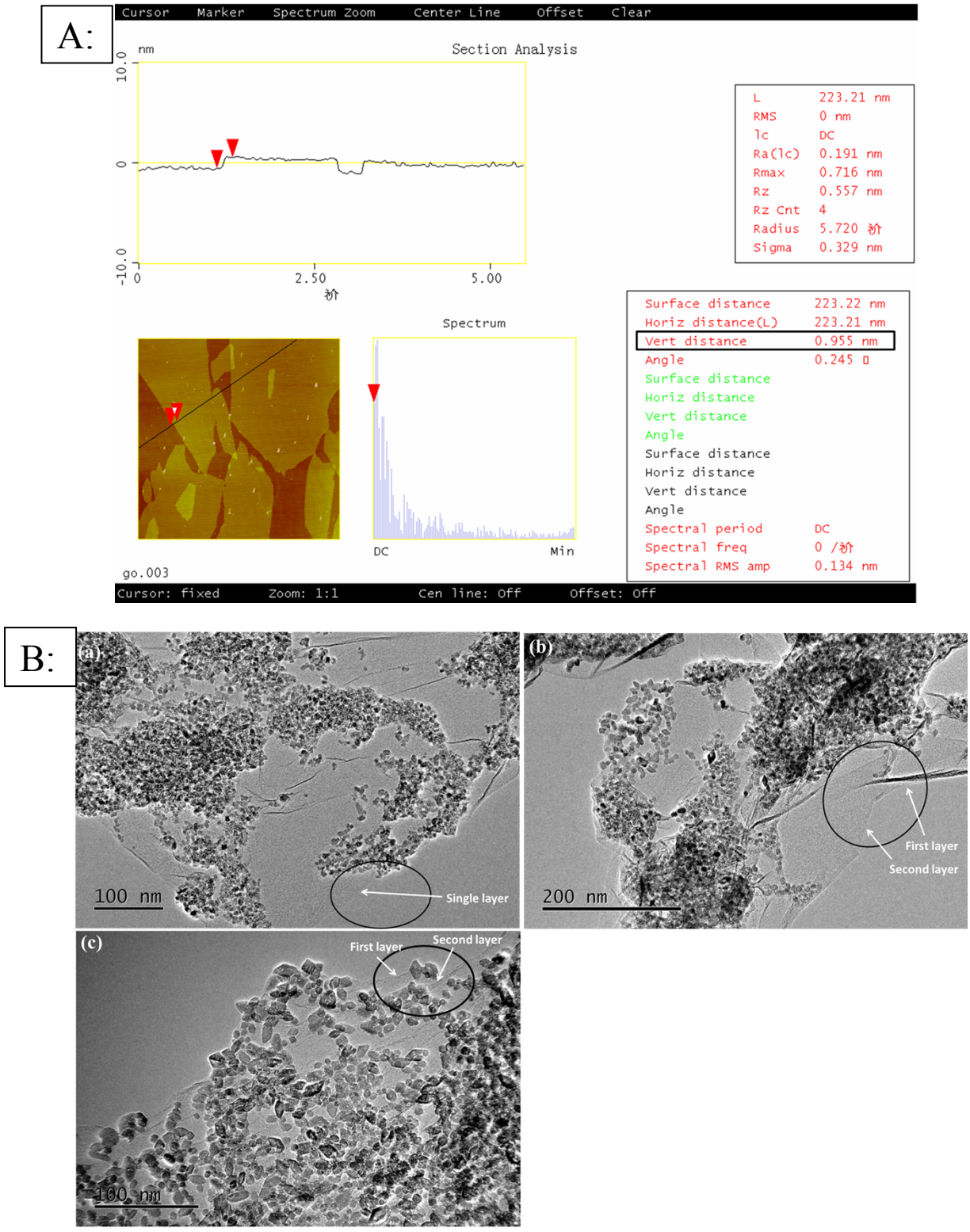

Fig. S2 AFM image and height profiles of the GO (Fig. S2A). TEM images of TiO_2-graphene composites. (a): without PVP, 150 ºC/5 h; (b): without PVP, 200 ºC/5 h; (c): with PVP, 240 ºC/5 h (T-240). According to the TEM images, we think less than three layers of rGO were inserted in the TiO_2/rGO composites (Fig. S2B).

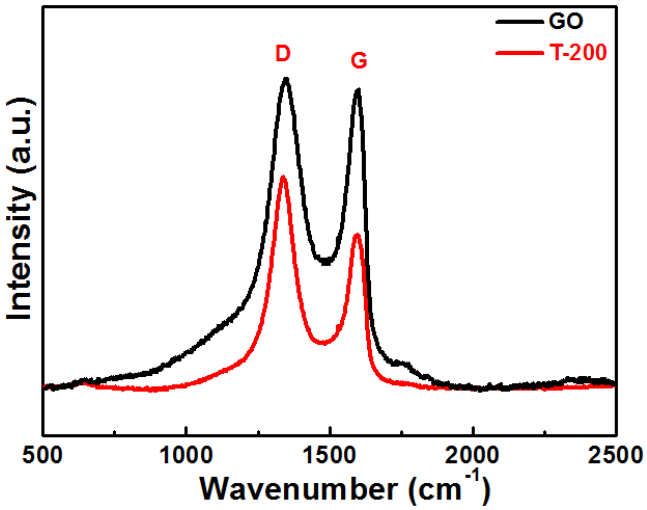

Fig. S3 Raman spectra (λ = 532 nm) of GO (black) and **T-200** (red).

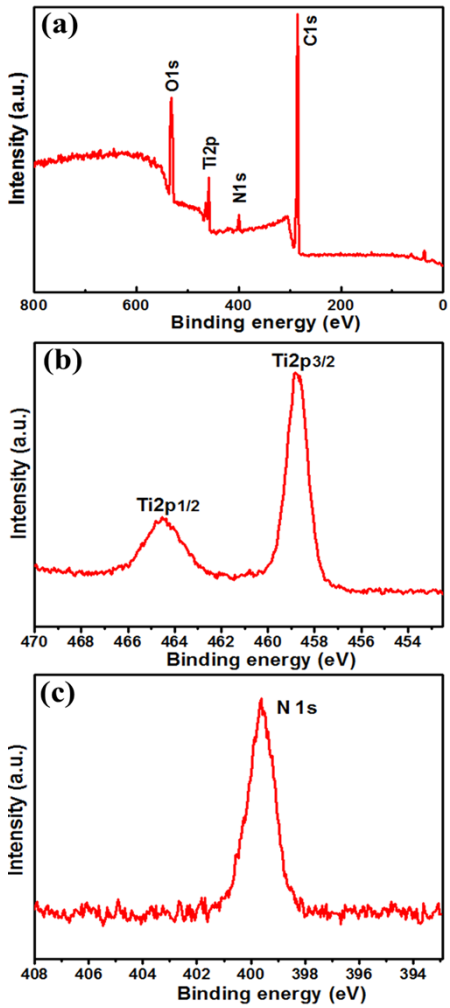

Fig. S4 XPS spectrum of **T-200** (a), high resolution XPS Ti 2p spectrum (b), high resolution XPS N 1s spectrum (c). The sample **T-200** was composed of C, O, N and Ti. It can be found Ti was Ti(+4) and the nitrogen was as pyrrolic nitrogen atoms (399.6 eV).

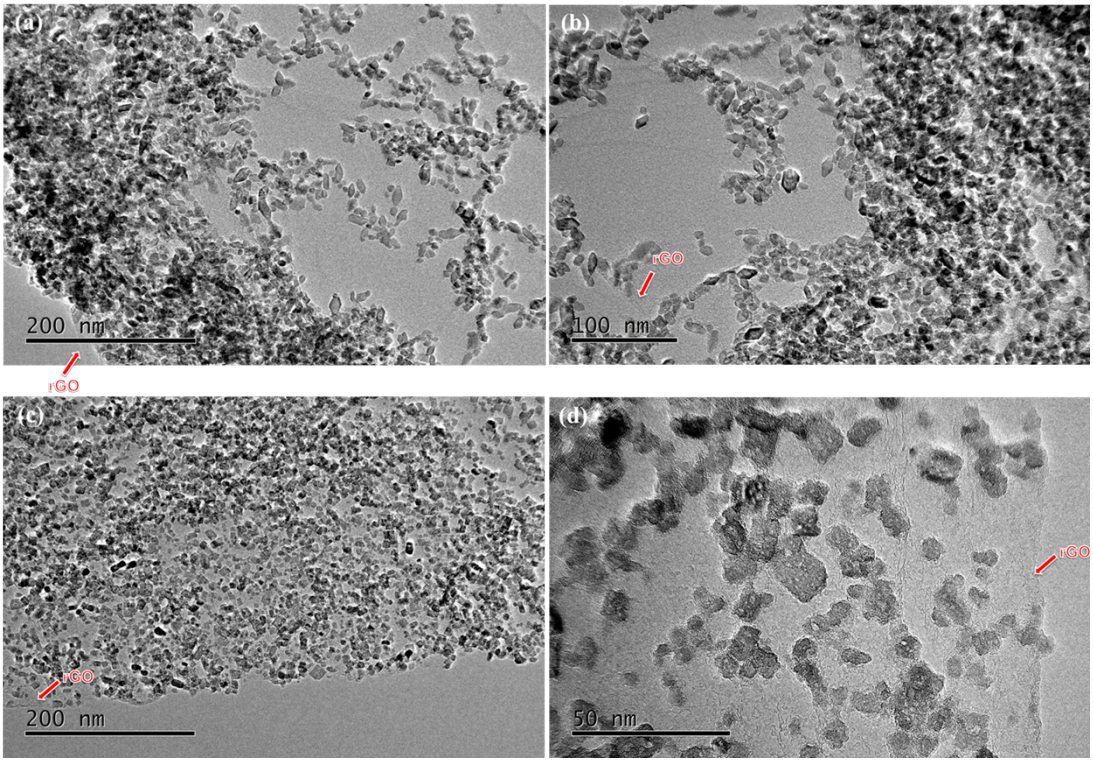

Fig. S5 TEM images of TiO_2-graphene with H_2O (a-b) and triethylene glycol (c-d) as the solvent respectively.

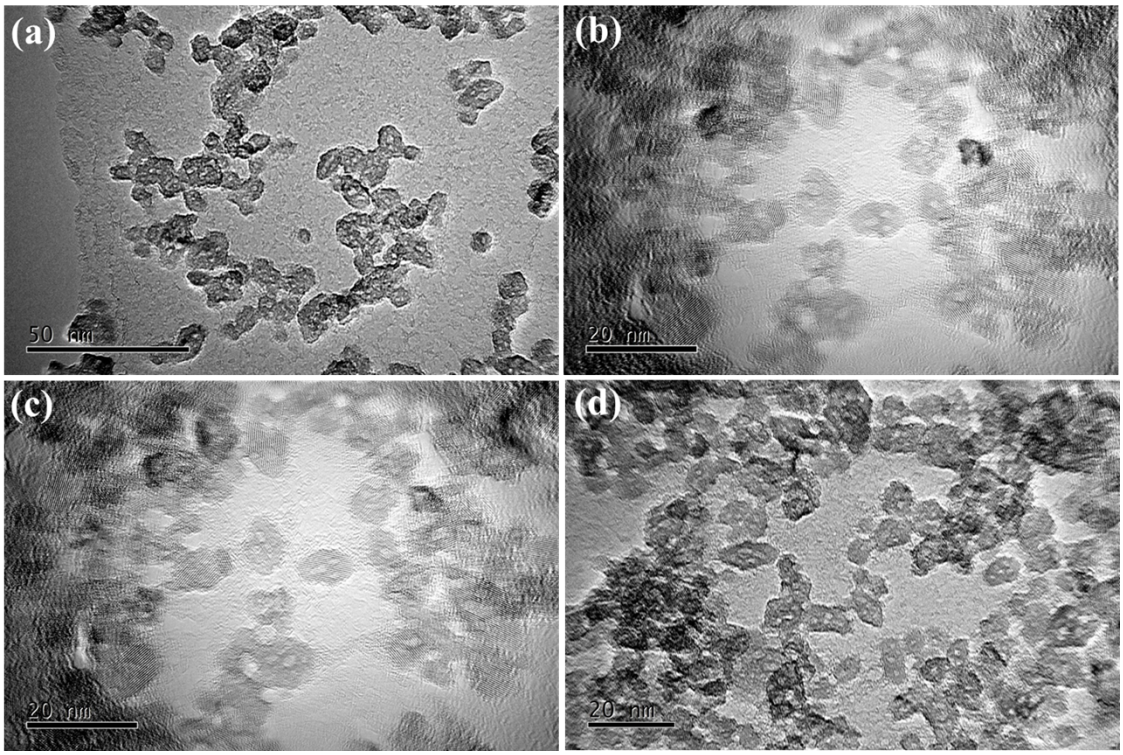

Fig. S6 TEM images (a-d) of TiO_2-graphene composites where the amount of PVP was quartered. When the amount of PVP was decreased, the TiO_2 nanocrystals was not loaded so uniformly when comparing with **T-200**. However, the pores could still be seen clearly.

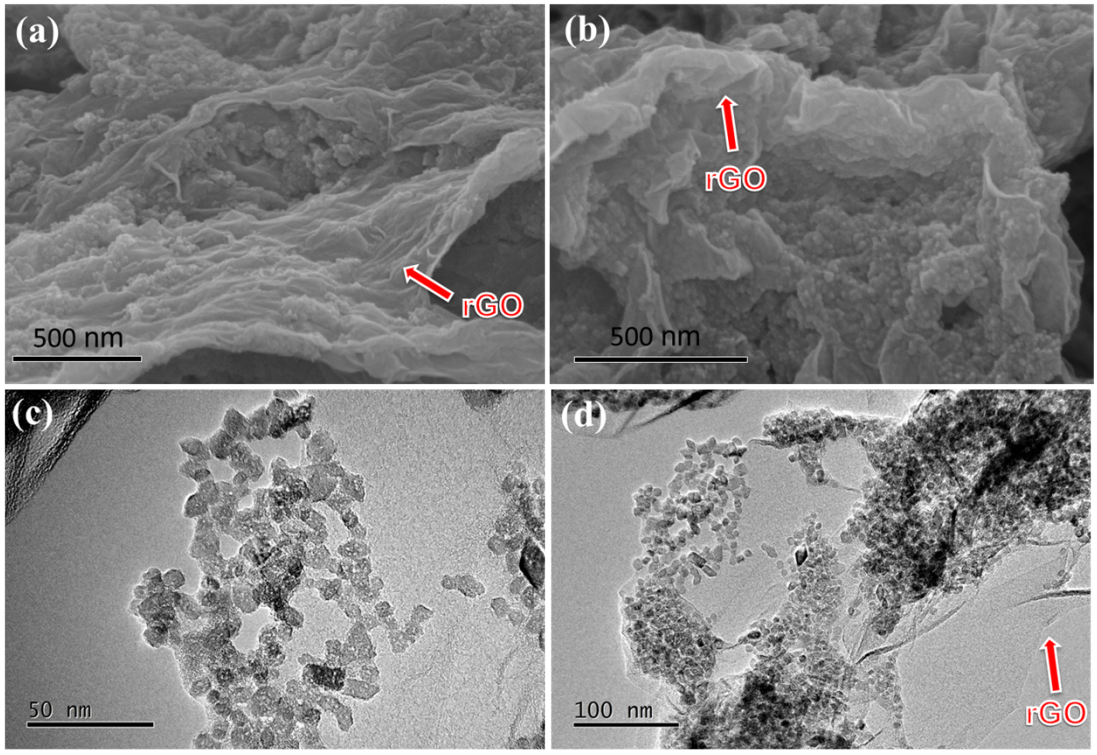

Fig. S7 SEM images (a-b) and TEM images (c-d) of TiO_2-graphene composites. It was found that when the PVP molecules were absent, the pores were still present. However, the TiO_2 nanocrystals aggregated on the graphene surface.

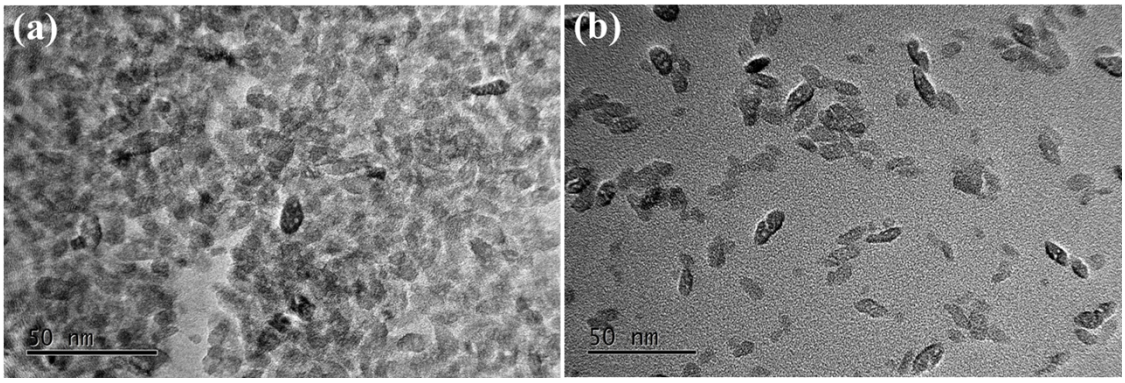

Fig. S8 TEM images (a, b) of TiO_2 nanocrystals. The TiO_2 nanocrystals were prepared using PVP as the stablizer.

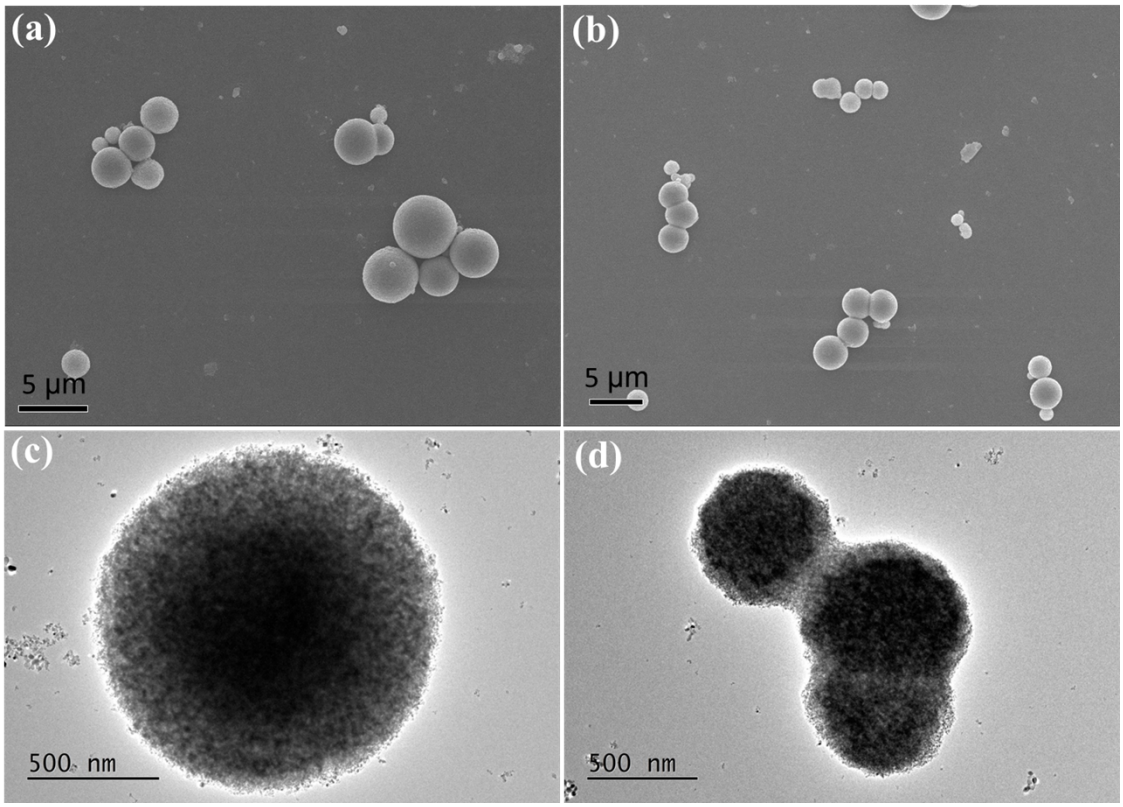

Fig. S9 SEM (a,b) and TEM (c,d) images of TiO_2. The TiO_2 was prepared through adding the $TiCl_3$ solution into the ethanol directly and no PVP and GO was used. It can be seen that the TiO_2 nanocrystals aggregated seriously and the TiO_2 microspheres with different diameters were observed.

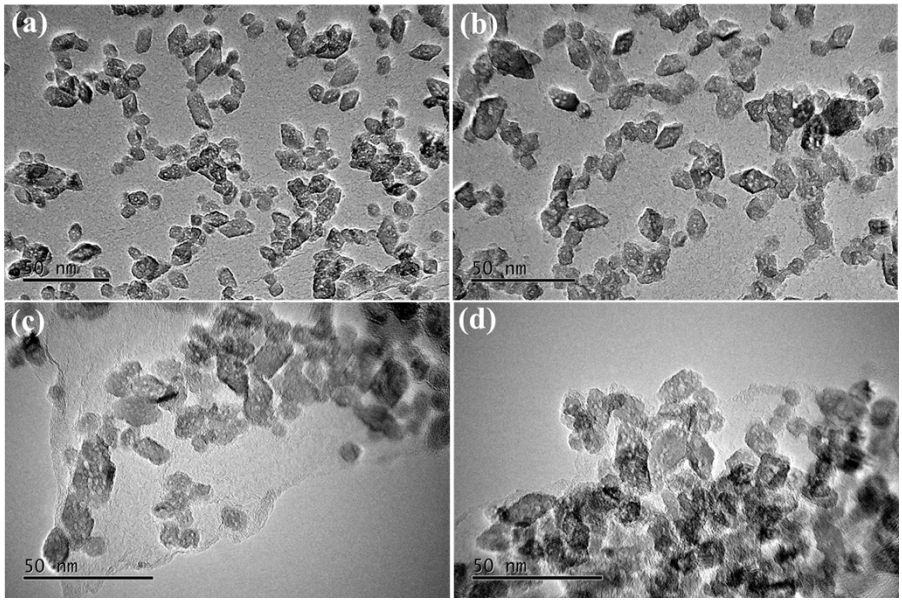

Fig. S10 TEM images of TiO_2-graphene with solvothermal temprature at 200 ^oC. The solvothermal time was 24 h (a,b) and 72 h (c,d) respectively.

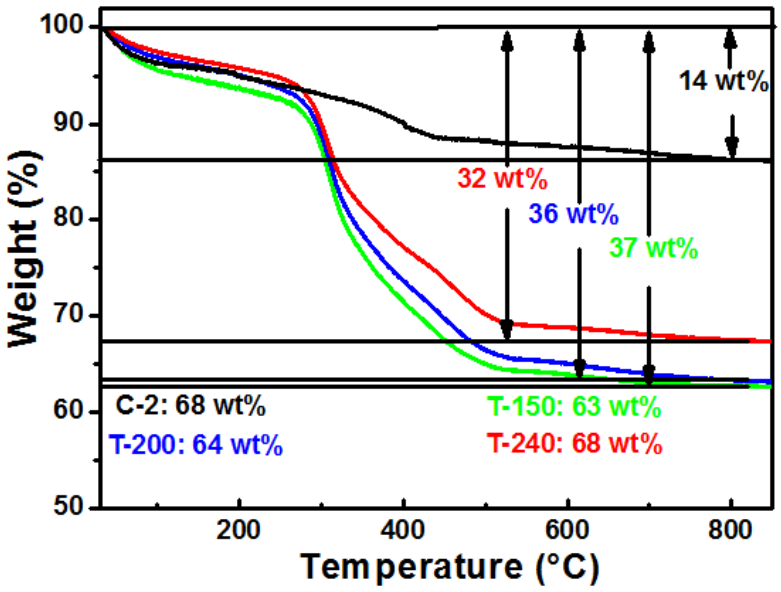

Fig. S11 TGA analysis of **T-150**, **T-200**, **T-240** under a flow of air with a temperature ramp of 5 ^{o}C/min from room temperature to 850 ^{o}C.

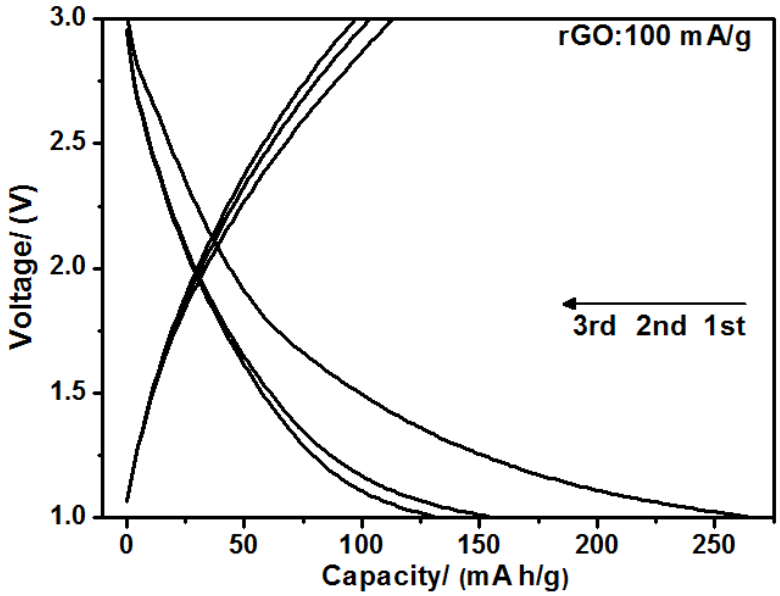

Fig. S12 Charge–discharge curves of rGO cycled at 1.0-3.0 V under a current density of 100 mA g^{-1}.