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MOF-derived, N-doped porous carbon coated graphene sheets as high-performance anodes for lithium-ion batteries

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GO: Graphite oxide (GO) was synthesized from natural graphite powder by a modified Hummers method[1]. Graphite powder (3 g) was added into an 80 °C solution of concentrated H_2SO_4 (12 mL) with K_2S_2O8 (2.5 g) and P_2O_5 (2.5 g). The mixture was kept at 80 °C for 4.5 h using a hotplate. Successively, the mixture was cooled to room temperature and diluted with 0.5 L of de-ionized (DI) water and left overnight. Then, the mixture was filtered and washed with DI water using a filter to remove the residual acid. The product was dried under ambient condition overnight. This pre-oxidized graphite was then subjected to oxidation by Hummers' method described as follows. Pre-oxidized graphite powder was put into 0 °C concentrated H_2SO_4 (120 mL). Then, 15 g $KMnO_4$ was added gradually under stirring and the temperature of the mixture was kept to be below 20 °C by cooling. Successively, the mixture was stirred at 35 °C for 2 h, and then diluted with 250 mL DI water and the addition of water was carried out in an ice bath to keep the temperature below 50 °C. After adding all of the 250 mL of DI water, the mixture was stirred for 2 h, and then additional 0.7 L of DI water was added. Shortly after the dilution with 0.7 L of water, 20 mL of 30% $H_2O_2$was added to the mixture, and the color of mixture changed into brilliant yellow along with bubbling. The mixture was filtered and washed with 1:10 HCl aqueous solution (1 L) to remove metal ions followed by 1 L of DI water to remove the acid. The resulting solid was dried in air and diluted to make a GO dispersion.

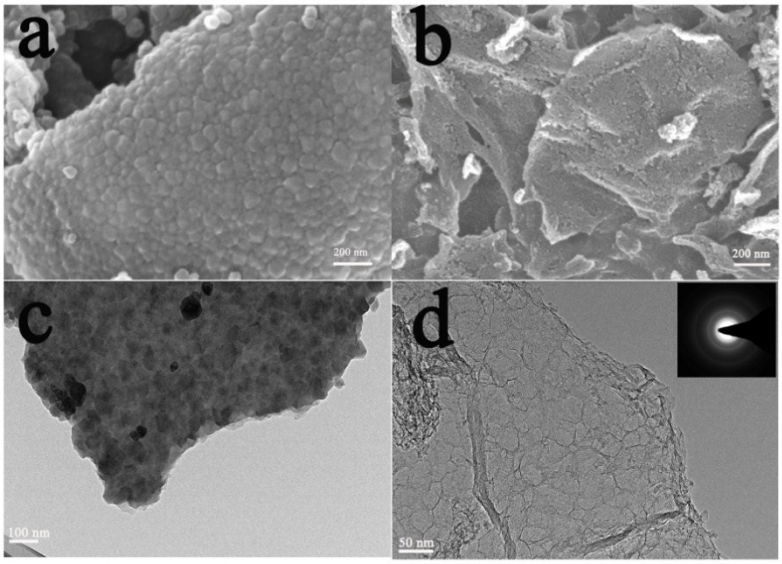

Fig.S1 (a and b) SEM images and (c and d)TEM images of the ZIF-8/GO and NPCGS. The inset of (d) is a selected-area electron diffraction pattern of NPCGS.

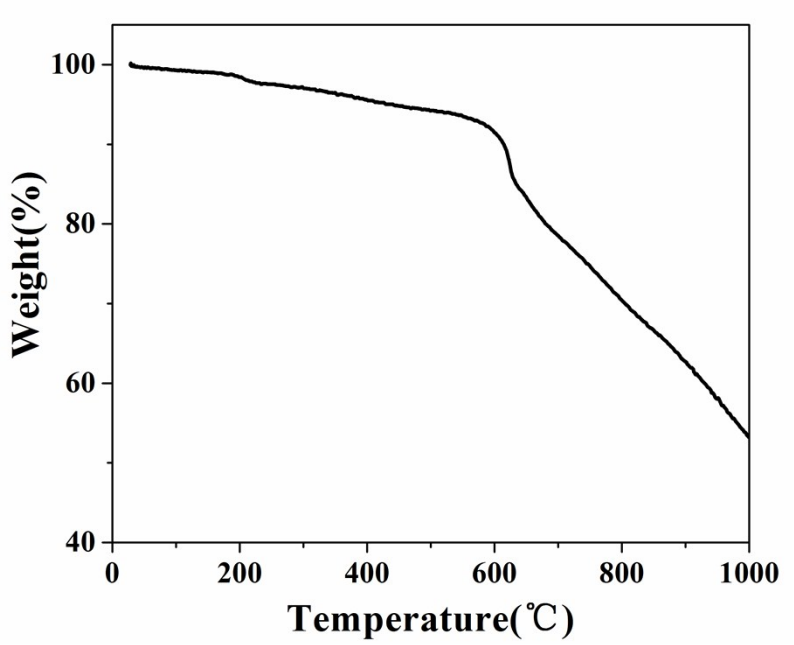

Fig.S2 TG curves of the ZIF-8/GO under Ar flow.

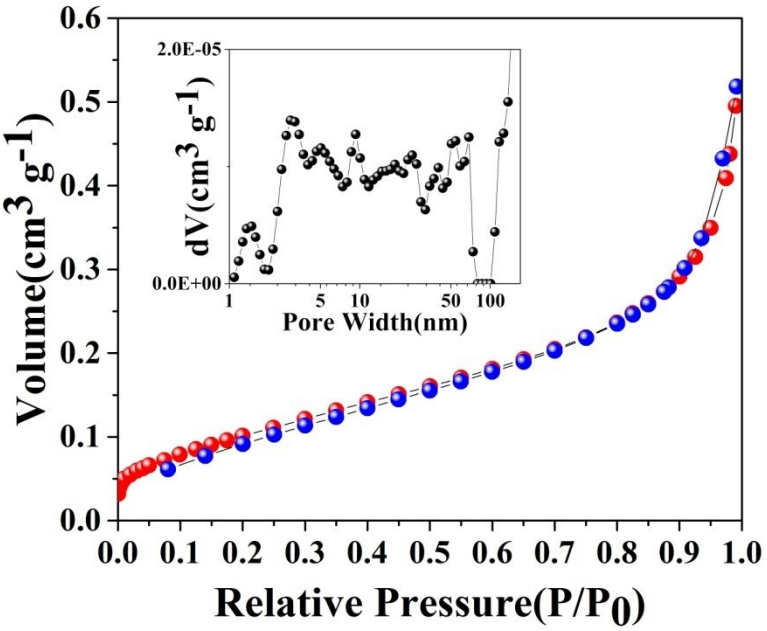

Fig.S3 Nitrogen adsorption–desorption isotherms of NPCGS. The inset shows the pore size distribution.

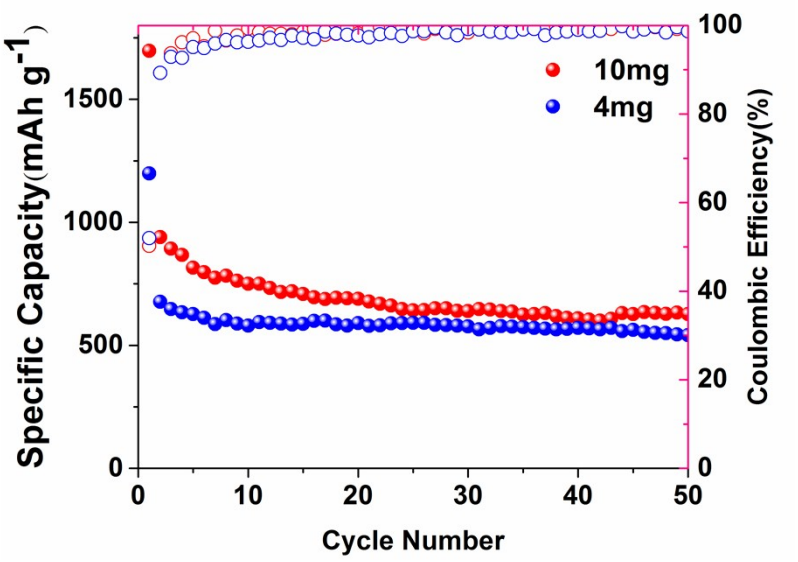

Fig.S4 Cycling performance of the NPCGS anode with different ratio of NPC and rGO at the rate of 0.5 A g^{-1}.

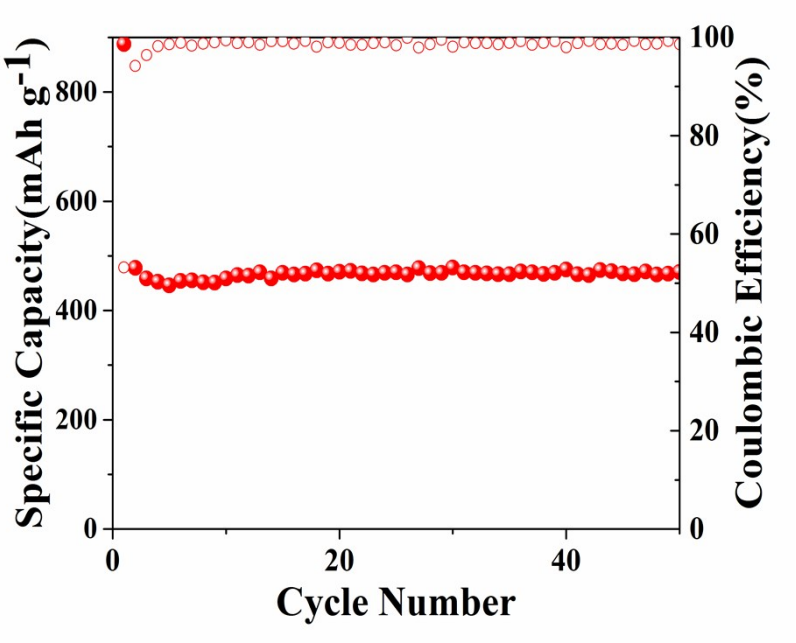

Fig.S5 Cycling performance of physical mixture of N-doped porous carbon and rGO at the rate of 0.5 A g^{-1}.

1. Y. Xu, H. Bai, G. Lu, C. Li and G. Shi, *Journal of the American Chemical Society*, 2008, **130**, 5856-5857.