Electronic Supplementary Information

Binding TiO$_2$-B nanosheets with N-doped carbon enables highly durable anodes for lithium-ion batteries

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Supplementary Method S1: calculation details for the separation of the diffusion- and capacitive-controlled charge

Generally, the total current (or charge) of the electrode at a certain potential comprises two components, described by the equation of $i(V) = k_1v^{1/2} + k_2v$ and $i(V)/v^{1/2}= k_1 + k_2v^{1/2}$ (Eq. 1), based on the power law relationship of $i = av^{1/2}$ for the diffusion-controlled processes and $i = av$ for the capacitive-controlled processes. From the cyclic voltammograms at various scan rates of 0.1–2 mV s$^{-1}$, the current values can be determined when the voltage is given. According to Eq. 1, the values of $k_1$ (intercept) and $k_2$ (slope) at a fixed potential can be determined by plotting curves of $i(V)/v^{1/2}$ vs. $v^{1/2}$ ($v$ varies from 0.1 to 2 mV s$^{-1}$). When $k_1$ and $k_2$ values at each voltage are quantified, the values of $k_1v^{1/2}$ and $k_2v$ at a certain scan rate ($v$) can be determined, thus the diffusion-controlled current ($k_1v^{1/2}$) and capacitive-controlled current ($k_2v$) be separated.
**Fig. S1** Structure characterizations of NPC: (a) XRD pattern, (b) survey XPS spectrum, inset is the high-resolution XPS N 1s spectrum and (c) nitrogen adsorption/desorption isotherms, inset is the pore-size distribution. All peaks in the XRD pattern can be indexed to hard carbon. The survey XPS spectrum shows three peaks of C 1s, N 1s and O 1s, indicating the existence of doping N in the NPC material, which can be further confirmed by the high-resolution XPS N 1s spectrum. The NPC demonstrates a meso- and microporous structure with a large BET surface area of 2611 m² g⁻¹.
Fig. S2 Raman spectrum for the NPC-TiO$_2$-B hybrid.

Fig. S3 TG curve for the precursor of the NPC-TiO$_2$-B hybrid. Accordingly the carbon content in the NPC- TiO$_2$-B hybrid is about 14 wt.%. 

S3
**Fig. S4** (a-c) SEM images of the NPC-TiO$_2$-B hybrid. Numerous nanosheets grow inside and outside the carbon skeleton, forming a bulky hybrid architecture of dozens of micrometers in width and length.

**Fig. S5** SEM images of TNS (a,b) and NPC (c,d).
**Fig. S6** Electrochemical lithium-storage performance of the TNS and TNS/NPC electrodes: discharging-charging at a current density of 500 mA g\(^{-1}\).

**Fig. S7** EIS spectra for the three electrodes after 1 discharge-charge cycle.
Fig. S8 Ex-situ high-resolution XPS spectra of Ti 2p for the NPC-TiO$_2$-B electrodes at various states of discharge then charge.