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Multi-Walled Carbon Nanotubes Induced Controllable TiO_2 Morphology Transformation for High-Rate and Long-Life Lithium-Ion Batteries

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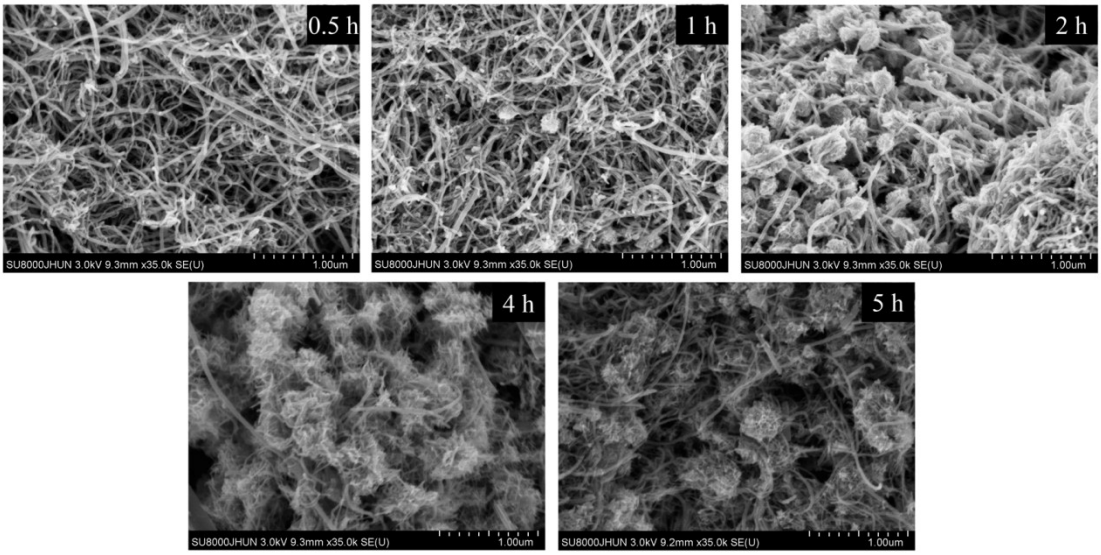

Fig. S1 FE-SEM images of TNP@CNT HNs-1 obtained at different reaction time: 0.5 h, 1 h, 2 h, 4 h, and 5 h.

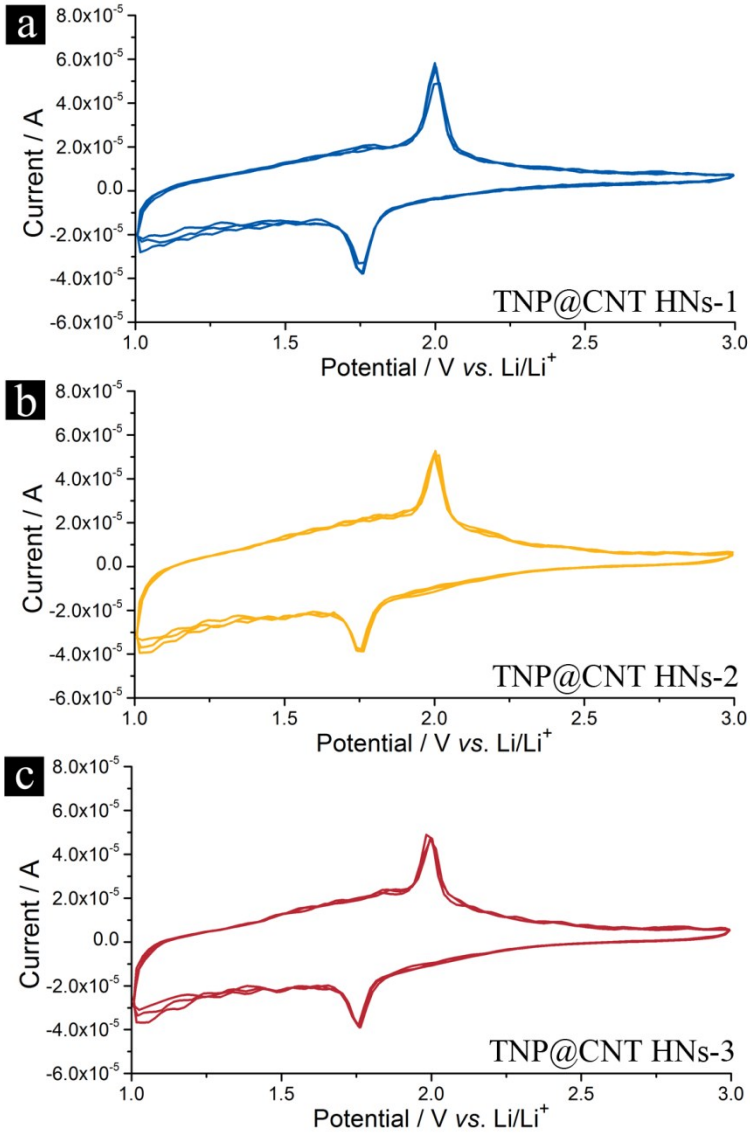

Fig. S2 Cyclic voltammograms of (a) TNP@CNT HNs-1, (b) TNP@CNT HNs-2, and (c) TNP@CNT HNs-3, for the first three cycles between 1.0 and 3.0 V at a scan rate of 0.1 mV s^{-1}.

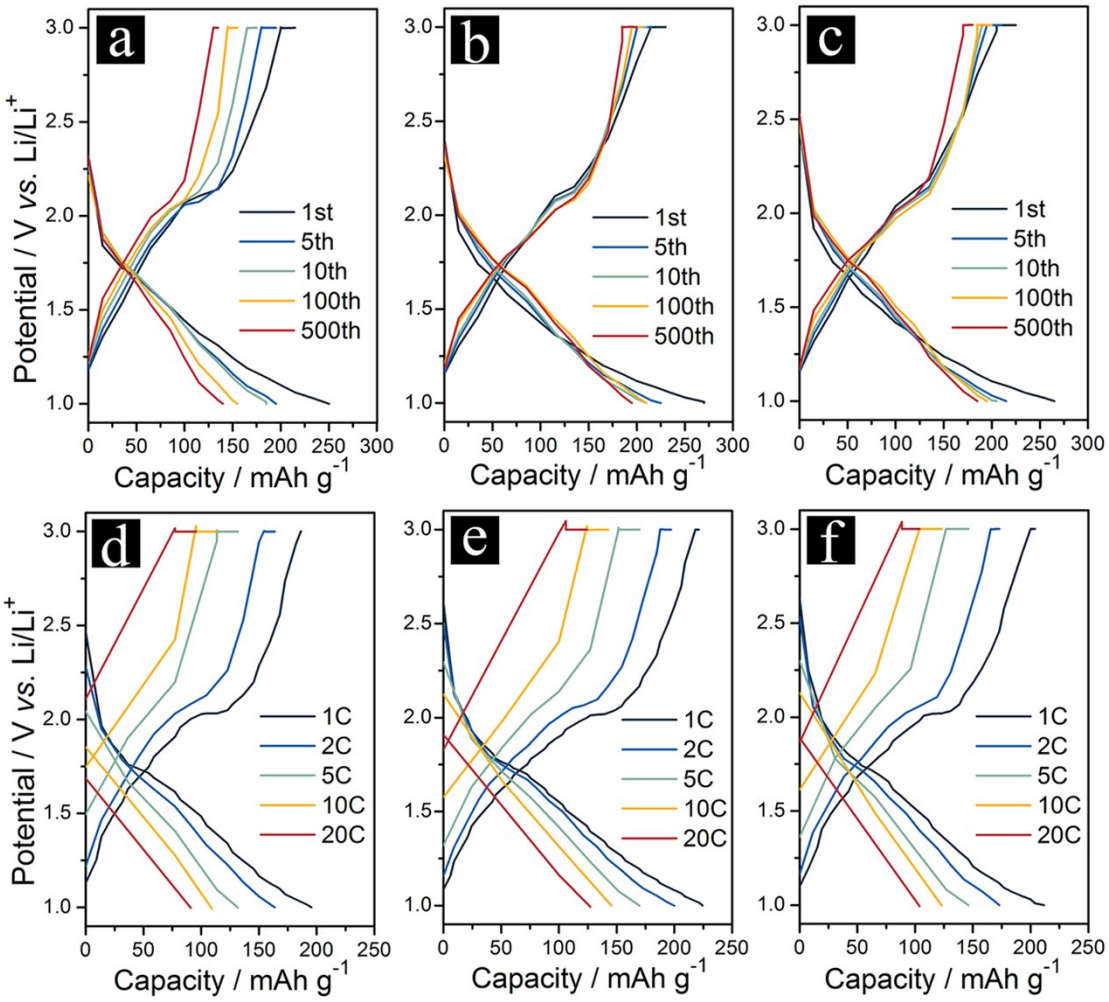

Fig. S3 The charge-discharge galvanostatic curves for (a) TNP@CNT HNs-1, (b) TNP@CNT HNs-2, and (c) TNP@CNT HNs-3 cycled at a current rate of 2 C (340 mA g^{-1}) in the voltage range from 1.0 to 3.0 V. The rate capability for the batteries based on (d) TNP@CNT HNs-1, (e) TNP@CNT HNs-2, and (f) TNP@CNT HNs-3 with increasing rates from 1 C (170 mA g^{-1}) to 20 C (3.4 A g^{-1}).

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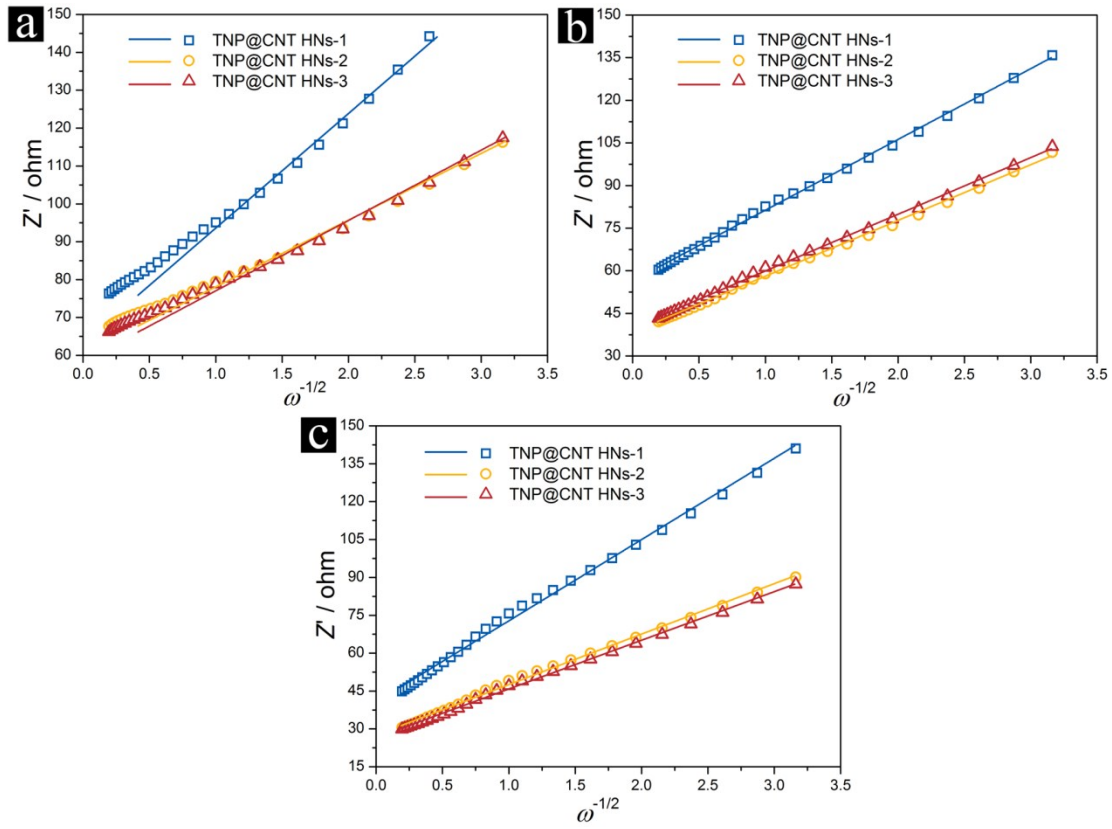

Fig. S4 The linear fitting of Z' *vs.* $\omega^{-1/2}$ plots for different TNP@CNT HNs anodes: (a) before initial cycle, (b) after 100 cycles and (c) after 500 cycles at 2 C rate (340 mA g^{-1}) between 1.0 and 3.0 V.

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Table S1 The calculated lithium diffusion coefficients of TNP@CNT HNs-1, TNP@CNT HNs-2, and TNP@CNT HNs-3.

Samples	D_{Li} ($cm^2\ s^{-1}$) Before 1st cycle	D_{Li} ($cm^2\ s^{-1}$) after 100 cycles	D_{Li} ($cm^2\ s^{-1}$) after 500 cycles
TNP@CNT HNs-1	2.361×10^{-6}	1.227×10^{-6}	1.432×10^{-6}
TNP@CNT HNs-2	7.982×10^{-6}	1.753×10^{-6}	2.967×10^{-6}
TNP@CNT HNs-3	8.867×10^{-6}	4.438×10^{-6}	6.329×10^{-6}