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Electronic Supplementary Information

Facile shape control of nano-coaxial $\text{Co}_3\text{O}_4/\text{TiO}_2$ arrays and the effect of the microstructure on lithium storage capability

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Supporting Figures

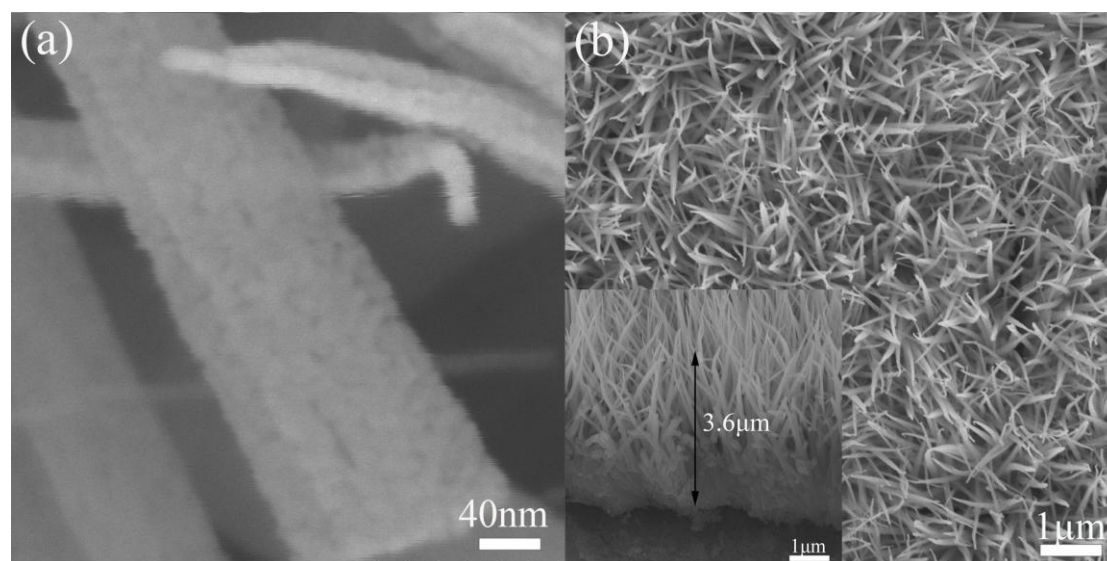


Fig. S1 (a) High-magnification image of Co_3O_4 NW from S-2; (b) low-magnification image of Co_3O_4 NWs array from S-1, and its cross-sectional view (inset).

Obviously, one Co_3O_4 NW is composed of numerous nanoparticles showing a porous trait and lots of NWs stand basically straight up from the substrate with plenty of inter-wire space between these NWs.

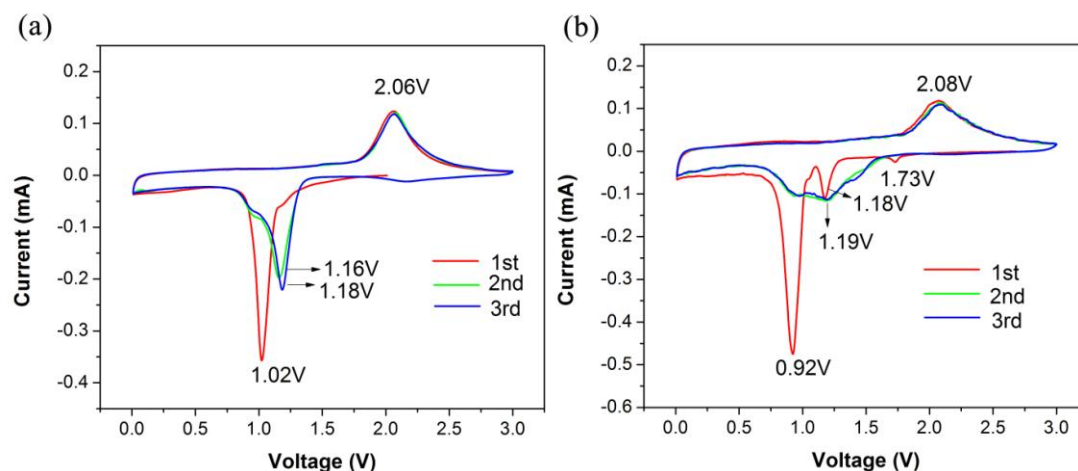


Fig. S2 (a) CV of the Co₃O₄ NW arrays of S-1, (b) Co₃O₄/TiO₂ core-shell nanohybrids of S-1.

It is noteworthy that both the peak current and the integrated area of the cathodic/anodic peak are almost constant after the 2nd cycle, indicating both the formed SEI layer and the electrode materials are highly stable.

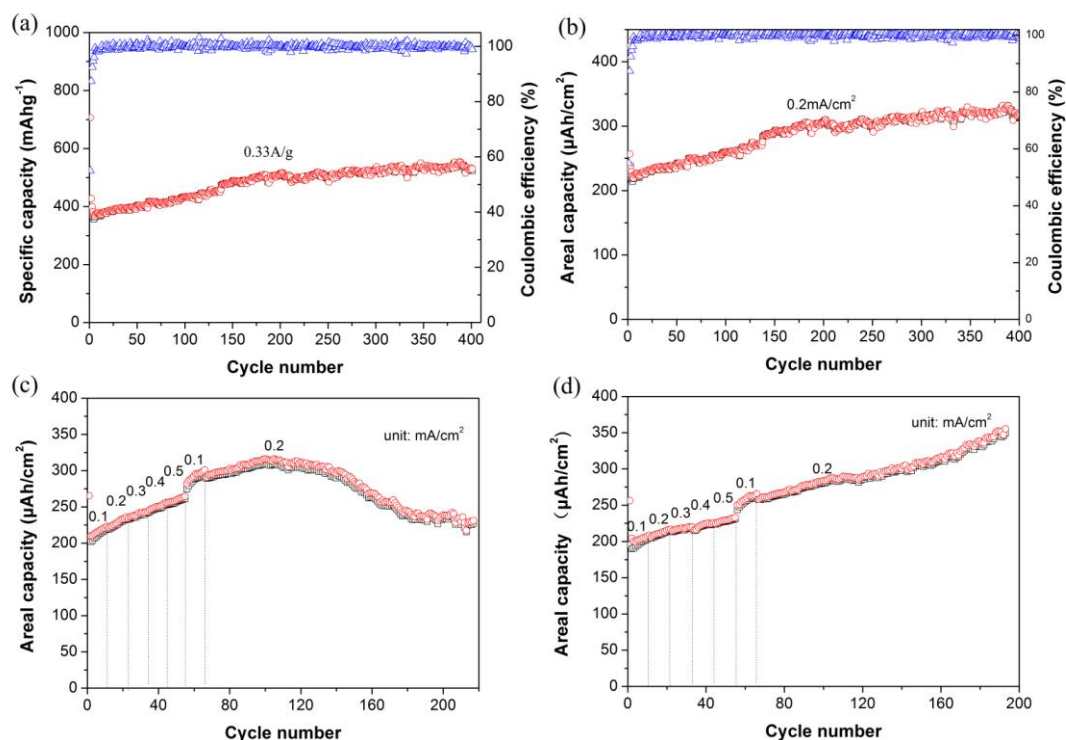


Fig. S3 (a) Cycling performance (specific capacity) and Coulombic efficiency of the Co₃O₄/TiO₂ nanohybrids from S-1 at a current density of 0.33 A/g; (b) Cycling performance (areal capacity) and coulombic efficiency of the Co₃O₄/TiO₂ nanohybrids from S-1 at a current density of 0.2 mA/cm²; (c and d) Cycling responses of pure Co₃O₄ NWs and Co₃O₄/TiO₂ nanohybrids from S-1 at programmed current densities, respectively.

Compared with pristine Co_3O_4 NWs, nanohybrids with thick TiO_2 shell exhibit good cycling stability but limited specific capacity. It should be noted that Co_3O_4 electrode exhibits no more than $400 \mu\text{Ah}/\text{cm}^2$ in S-1, though it is quite stable compared to S-2. (c) and (d) compared the rate performance between Co_3O_4 electrode and $\text{Co}_3\text{O}_4/\text{TiO}_2$ electrode, from which we cannot distinguish the better one due to the activation progress during the early stage. But the hybrids still exhibit better cyclability after 120 cycles, which may be attributed to the coating effect of the stable TiO_2 shell.

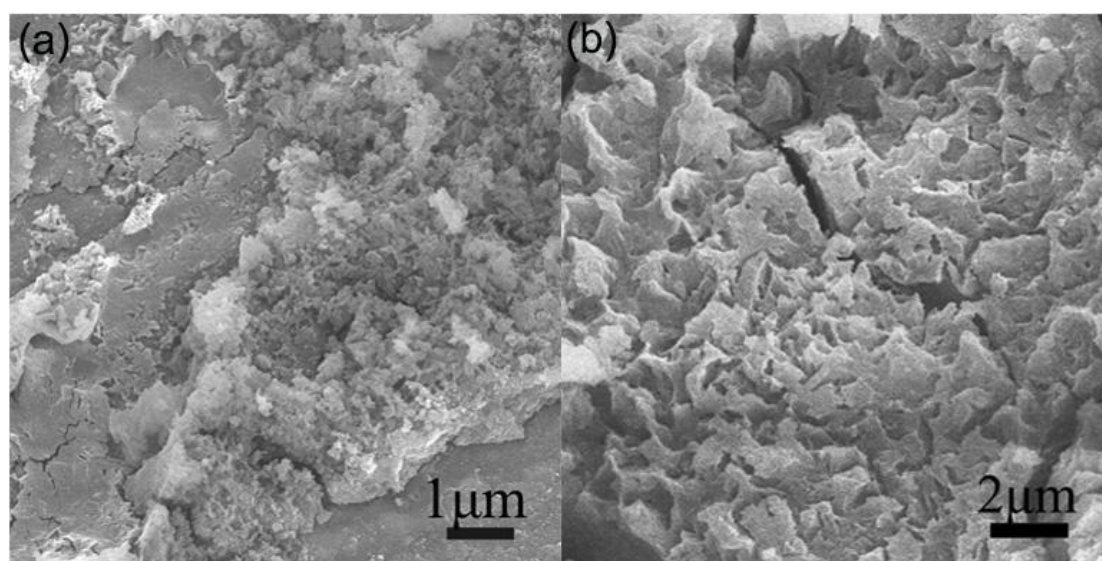


Fig. S4 (a) SEM image of the Co_3O_4 NW arrays after 200 cycles at $0.2\text{mA}/\text{cm}^2$; (b) SEM image of $\text{Co}_3\text{O}_4/\text{TiO}_2$ nanohybrids after 200 cycles at $0.2\text{mA}/\text{cm}^2$.

Fig. S4 shows typical SEM images of the two electrodes after galvanostatic charge-discharge cycling. Both samples no longer maintain nanowire morphology after repeating charge-discharge process. Obvious pulverization and exfoliation of the Co_3O_4 film are observed all over the current collector after the 200th cycle in Fig. S4a, which would be regarded as the main cause of the capacity decay. Contrarily, the morphology of $\text{Co}_3\text{O}_4/\text{TiO}_2$ electrode after 200 cycles shows much less exfoliation though slight cracking can be seen due to vast volume expansion. Considering the coating effect of TiO_2 shell, the enormous volume change and internal strain are accommodated to restrict cracking. The results demonstrate that the core-shell nanohybrids can accommodate the strain and keep the structural integrity during many cycles.